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ADDRESS OF THE PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES[1]

By Dr. W. W. CAMPBELL

PRESIDENT EMERITUS OF THE UNIVERSITY OF CALIFORNIA

Mr. Minister of Norway,
Members of the National Academy and esteemed Guests:

WITH one exception the several speakers of this evening will be formally introduced, and you will observe that their addresses fit into a logical plan. It will make me feel better if I exercise the privilege of telling you that I, as the one exception, am making an address at the request of the academy's council, and not upon my own initiative.

The academy's dinner of each year is attended for the first time by many of its recently elected members. It is a safe guess that those new members have an incomplete understanding of the historic reason for the academy's creation and existence. It was in the middle year of our great war between the states, the year 1863, that the United States Government, feeling the need for a definite and responsible organization of the scientists of the nation to which it could go at any time for information and advice on scientific subjects, incorporated and constituted the National Academy of Sciences, by a special Act of Congress. This act, in effect the charter of the academy, is a remarkable document; remarkable in its brevity, its clarity and in my opinion its wisdom.

The first paragraph of the congressional act consists of the statement that fifty American scientists whose names are recorded in alphabetical order, beginning appropriately with Louis Agassiz, of Harvard, on the Atlantic coast, and ending with "J. D. Whitney, California; their associates and successors

[1] Given at the annual dinner, April 23, 1935.

duly chosen, are hereby incorporated, constituted and declared to be a body corporate, by the name of the National Academy of Sciences."

The remaining fifteen lines of the printed charter contain five specifications, which I shall now quote, and briefly comment upon:

Firstly, ". . . the National Academy of Sciences shall consist of not more than fifty ordinary members." The Congress, in 1870, removed the limitation placed upon the number of ordinary members and the Academy has itself fixed the limit, for the time being, at three hundred. The actual number is now 275, of whom two are women. There are also forty-four foreign associates; that is, honorary members, eminent scientists of other nations.

Secondly, ". . . the National Academy of Sciences shall hold an annual meeting at such place in the United States as may be designated." The academy's annual meeting is held always in the city of Washington, in the month of April. The academy holds a stated meeting in the autumn of each year, always at some center of higher education or research activity other than Washington. It met last November in Cleveland. It will meet next November at the University of Virginia.

Thirdly, there is the specification which defines the purpose, apparently the sole purpose, of the Congress in establishing the academy, namely: ". . . the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art (meaning the practical arts), the actual expense of such investigations, examinations, experiments, and reports to be paid from appropriations which may be made for the purpose, but the Academy shall receive no compensation whatever for any services to the Government of the United States."

As an unwritten corollary to this specification, I may say for the special benefit of our newer members that the American citizen, the American scientist, who accepts election to membership in the academy tacitly agrees to respond to the Government's call for the study of, and report and advise upon any subject lying within his field of special interest, and without expectation of financial recompense for his services. In the 72 years of its existence the academy has complied a great many times to requests from the government for information and advice, gladly, and as promptly as practicable, on problems exhibiting a wide range of character and magnitude. The academy, naturally and in accord with the expectations of the Congress in 1863, is uniquely prepared to meet the Government's needs. To describe one recent case in illustration of that fact: When the National Planning Board, operating under the auspices of the Interior Department, on April 24 of last year, formally requested the National Academy of Sciences to advise it concerning "The Rôle of Science in National Planning," the academy's report to be made available to the board well before the close of June, I assigned the duty of conducting as comprehensive a study of the subject as the time limitation would permit, and of preparing the report, to the academy's standing Committee on Government Relations, consisting of John C. Merriam, *chairman*, the president and the vice-president of the academy, the chairman of the National Research Council, the chairman of the academy's eleven several sections, and the chairman of the Division of Federal Relations of the Research Council—a committee of sixteen members representing, very appropriately in this particular problem, every one of the principal fields in the domain of the physical and the biological sciences. At the same time advantage was taken of the academy's constitutional provision which says that "It shall be competent for the president, in special cases, to call in the aid, upon committees, of experts or men of special attainments not members of the academy," to add to the resources of the committee the valued knowledge, experience and judgment of twelve distinguished scientists not members of the academy, and also of eleven additional academy members; making a total personnel of thirty-nine. The committee's report, published in the Academy's Annual Report for 1933–34, was finished, thanks largely to the chairman's energy and executive ability, and transmitted by the academy to the Planning Board on June 18, fifty-five days after the date of the request.

Recalling that the academy's members number about 275, and that they represent in reasonably normal proportions the several physical sciences and biological sciences, including medicine, psychology and anthropology, a modest application of arithmetical division suggests that the academy could, in case of emergency call, constitute a full score of committees composed of a dozen academy members each, without any overlappings of personnel, and without requisitioning its aged members. This is an imaginary "set-up" of committees: it will probably never occur in fact. The academy's collective membership represents uniquely in the United States a great reservoir of knowledge, experience and tested judgment on scientific subjects; and much can be said as to the wisdom of the Congressional plan that "any department of the Government" may call upon the academy for information and advice upon questions in any division of the physical sciences and the biological sciences. Academy committees can be, and always have been, constituted each in excellent accord with the nature of the problem involved.

It is a universally recognized fact that governments may count upon obtaining the most dependable advice,

in general, from institutions which are independent of political considerations and relationships, and whose members have no political interests except those possessed by all good citizens, and no financial or other material concern with the outcome of studies conducted for the government. I do not know of any other group of citizens of the republic who are so universally contented with their present lot as are the members of this academy. Using some ponderous language, I may proudly say that they are all interested in the eternal verities! They have been seeking the truth, as represented by scientific facts and principles, and they have been fairly successful in their quests; otherwise they would not be members of the academy. Looking in the opposite direction, I regard it as essential to the welfare of the academy, through the decades and centuries which lie before it, that the academy be at all times completely free of political elements in its organic and administrative relationships. I think the Congress of 1863, perhaps in response to the advices of some of the wise men who were prospective charter members of the academy, must have realized the importance of this condition, for,

Fourthly, there is a specification in the academy's congressional charter which says that the "corporation (*i.e.*, the National Academy of Sciences) hereby constituted shall have power to make its own organization, including its constitution, by-laws, and rules and regulations; to fill all vacancies created by death, resignation, or otherwise; to provide for the election of foreign and domestic members, the division into classes, and all other matters needful or usual in such institution, and"

Fifthly, the specification that the academy "report the same to Congress."

The charter conditions that the academy govern itself in all things, and that the academy receive no compensation whatever for any services to the Government of the United States, are precisely as they should be, as both the fundamental purposes of our institution and the traditions and experiences of similar institutions in the capital cities of other nations clearly proclaim. In confirmation of these facts, I can not do better than to quote from the annual address delivered by the president of the Royal Society of London, Sir William Huggins, in the year 1904: The Royal Society

> asks for no endowment from the State, for it could not tolerate the control from without which follows the acceptance of public money, nor permit of that interference with its internal affairs which, as is seen in some foreign Academies, is associated with State endowment. . . . The financial independence of the Royal Society, neither receiving nor wishing to accept State aid for its own private purposes, has enabled the Society to give advice and assistance which, both with the Government and with Parliament, have the weight and finality of a wholly disinterested opinion. I (the President of the Royal Society) may quote here the words of a recent letter from His Majesty's Treasury: Their Lordships have deemed themselves in the past very fortunate in being able to rely, in dealing with scientific questions, upon the aid of the Royal Society, which commands not only the confidence of the scientific world, but also of Parliament.

The Royal Society received its royal charter in the year 1662, and it was therefore 242 years old when President Huggins thus spoke. The Royal Society has had long experience, and it is very wise.

I have regarded the charter of the acedemy, received by gift of the Congress, as a trust closely approaching the sacred, to be violated or disregarded at the academy's peril. In accordance with the specific command of its charter from the Congress, the academy reports annually to the Congress.

The charter contains one clause which, speaking in a familiar manner, may be interpreted as a blanket provision conferring unspecified powers: "the National Academy of Sciences shall . . . have power . . . to provide for . . . all other matters needful or usual in such institution." It is thereby permitted, and may have been intended by its founders, that the academy shall be active in encouraging the extension of knowledge in the domain of the physical and the biological sciences, through research and discovery: firstly, by making a high degree of success in this field of endeavor the principal and essential criterion for election to membership in the academy; secondly, by the description and the interpretation of research results achieved by its members and other invited scientists, through the medium of papers presented at the academy's meetings; thirdly, by awarding medals and honoraria to members and non-members in recognition of notable research achievements, or for applications of science to the public welfare; fourthly, by making grants of money to members and non-members for the support of definite and promising research plans from funds which will have come to the academy by gifts and bequests; and in yet other ways. These things the National Academy has done with commendable success, as have also the leading academies of sciences in other nations.

In the first three decades of this century, and earlier, there was wide-spread recognition of the obvious fact that scientific discoveries and their applications were contributing enormously to the physical comforts and the material well-being of the peoples who dwell in what we may call the scientific nations:

scientific discovery, directly and indirectly, was responsible, above all other influences combined, for the raising of the standards of living and the lengthening of the average span of human life, in the astonishing degrees we are all aware of. Within the past three or four years, however, scientific discoveries, and especially the accelerated speed with which such discoveries had recently been made, have been under some degree of suspicion as to their resultant values to the human race. People in great and unaccustomed numbers have been suffering privations, both physical and spiritual, and they have been looking for the sources of their misfortunes. Scientific discoveries, coming too rapidly, have been blamed. However, the accusations have been made more or less irresponsibly, and apparently without basis of serious and comprehensive thought, or verified fact; for discoveries in science are but truth uncovered, truth which had been existing and operating a long, long time, though we didn't know it; and we have suffered no harm in suddenly learning about it.

It is doubtless true that advances of knowledge in the fields of the various sciences have, through their applications to the affairs of the world, subtracted from the demands for human labor in some of the older industries, but it should be remembered that these applications have to their credit the creation and development of new activities, many and on relatively large scales, which have undoubtedly given employment to greater numbers of both men and women than had been displaced from the earlier activities.

What is quite another thing, the applications of labor-saving machinery in factory and mill, on the farm and elsewhere, have with apparent reason been blamed for some of the ills of the world. Early in June, 1928, full sixteen months before the financial slump of October, 1929, I heard an able and well-informed man quote to a small but distinguished audience in New York City the indisputable evidence that in the few years then just passed, a great many thousands of workmen, both skilled and unskilled, in mills and factories had been displaced by labor-saving machines; displaced so rapidly that they failed in large measure to secure other positions; and that already there was much suffering in consequence. The speaker, whom many of you know very well, said in substance to the men before him, many of whose names are as household words to you: "If these conditions can develop and exist in the period of greatest manufacturing activity ever experienced in our country, what will happen when years of economic depression arrive? I ask and urge," said the speaker, "that you men of large affairs and wide experience give thought to the great problem which seems to lie ahead of us."

The predicted problem of unemployment and its dire consequences has certainly been with us, through the past five years. However, the labor-saving machinery under suspicion had but little relation, and much of it absolutely no relation to recent discoveries in science. For example, we have all seen labor-saving machinery at work in the construction of modern highways, and on the farms which certainly had no relation to recent discoveries in science![2] Rather were the offending machines, with relatively few exceptions, the products of mechanical engineers' and electrical engineers' inventive genius, aroused by the urge of the great war's abnormal demands and later by the urge of competition perhaps due in some measure to low wages in other lands and relatively high wages and other conditions at home. I do not pursue the subject further because, in my opinion, it lies almost wholly within the immense and important domain of economics and the social sciences.

There is one superlatively important consequence of discoveries and developments in the physical and the biological sciences which seldom gets any description or discussion in books and newspapers read by people in general. In preceding paragraphs I have been treating of science chiefly in its "bread and butter" aspects. I here refer to the profound influence of scientific discovery, through the decades and the centuries, upon our modes of thought, upon our freedom of speech and freedom of search for the truth, upon our ways of looking at life and life's affairs. The subject is a most tempting one, and if time were abundant, as it is not, I should have liked to develop it; but I must limit myself to a few more or less disconnected illustrations and statements.

Nearly forty years ago, while on a scientific mission in central India, I camped in a region whose people were suffering from their second year of famine. I could not induce any of the emaciated millions of Hindus around us to accept a slice of bread or a can of peaches because, for reasons attaching to their caste system, all our food, from their point of view, was unclean in the theological sense, and to eat it would destroy their chances of happiness in the world to come.

The Hindus and the Mohammedans and the other "fatalistic" peoples, with relatively few exceptions, have been falling far behind with respect to what we make bold to call world progress, not because they

[2] After this address was finished, I learned from *Time* for April 22, pages 36–38, that a machine for picking cotton, in replacement of human labor, has been invented and subjected to successful test. *Time* says that "In seven and a half hours it gathers as much cotton as a diligent hand-picker gathers in an eleven-week season." I doubt if it bears intimate relation to any recent discovery in science, but the subject might easily become one of vast importance, economically and politically.

have been retrograding in the absolute sense, but because the other peoples have relatively forged ahead. Their disadvantages have lain less in their failure to profit from the material benefits of applied science than in their holding to the mystical philosophies of old, which are "fatal" to progress. The essence of the philosophy of science is the cause-and-effect principle. The tenets of the scientific spirit tell us, whenever we are dealing with really serious matters, to "Prove all things; hold fast that which is good."

The year 1859, three quarters of a century ago, marked an astonishing epoch in the intellectual history of the world; in no previous year had so much been done to liberate the spirit of man. In that year was published the "Origin of Species"; in that year were discovered the principles of spectroscopy. It is true that many of the ideas on evolution antedated Darwin; but Darwin's systematized and fortified ideas took root, and thenceforward there developed rapidly the hypothesis, and I might almost say the conviction, that the principles of evolution are applicable to nearly all—perhaps all—things: to our ideas on almost any subject; certainly to the religions and the theologies of the earth's peoples; to the earth, in that it is not only very old, and the result of evolutionary processes, but that the earth's surface features and all things upon the earth are changing, more or less slowly evolving, in orderly manner, with the passing of time. Some of the revelations of the spectroscope antedated Kirchhoff; but with the ability to interpret spectroscopic observations of the sun, of the other stars, of the nebulae, there came rapidly a realization of the unity of the great universe. The earth is not only not flat; it is not the center of the universe; it is just one of the sun's smaller children; our sun itself is just a humble star among the billions of stars in our own stellar system; and there are, at the least, many tens of millions of other stellar systems. These are facts, established at the cost of great labor, and they have influenced and modified our ideas and attitudes most profoundly. No longer do we repeat the old dicta, "We shall never be able to know the chemical composition of the stars"; "The conditions existing in the deep interior of the earth must forever remain unknown"; and many similar beliefs of the last century and earlier.

The dread malady, diphtheria, now comes to a very low percentage of families, but with every comprehending family there resides an inspiring appreciation of the values beyond price which reside in the antitoxin made available by scientific research. Relatively few families have members or friends at sea, but every intelligent family finds mental and spiritual comfort in the knowledge that wireless telegraphy is ever alert to rob the oceans of their most cruel terrors. Our physicists have not yet learned what electricity really is, but I think they hold to the expectation that they or their successors will some day find out what it is. Their discoveries about the constitution of the atoms and the ways of their constituent parts promise to be as marvelous as the modern developments of astronomical knowledge. At any rate, the physicists know much more about electricity than the astronomers do about gravitation. We know something of what gravitation is doing, and of what it will do, but we seem to know nothing about the mechanism of its action, nothing of the technical reason why it exists. Of all the forces known to man, gravitation is marvelous beyond compare. The velocity of light and of electricity, 186,000 miles a second, seems to be a snail's pace in contrast with the effective speed of gravitational action. Pulses of light, emitted by the sun, require 500 seconds for their journey to the earth, whereas the sun's gravitational pull upon the earth, compelling the earth to travel in its elliptic orbit, seems to act instantaneously across the gap of 93 millions of miles. At any rate, the tests of that hypothesis have been many, and not one of them has given or suggested an answer to the contrary. The gravitational action of two bodies upon each other seems not to be affected or modified by the placing or presence of other bodies, no matter how massive, between them: a pebble at my foot at midnight and the farthermost atom of calcium on the far side of the sun are thought to attract each other precisely as they would if the entire body of the earth, save that one pebble, and the entire body of the sun, save that one calcium atom, were annihilated and non-existent. The strength of the mutual gravitational pull of two bodies seems not to depend upon their temperatures, their magnetic states or any other known conditions.

I have mentioned these well-known facts not at all for the information of any single member of this intelligent audience, but to link a few of the many marvelous accomplishments of the past with some of the outstanding mysteries of the present, in illustration of the spirit of science which says that research will proceed in the hope and expectation that with the passing of the centuries and the millennia the greatest of mysteries in our surroundings on the earth and in the universe will one by one be resolved. Why should we not have confidence that many children of to-day will live to see all the infectious and contagious diseases, including infantile paralysis, banished from the earth, through the discoveries of medical science and the administrations of public health services? Why should not man aim at an ever more complete comprehension of the universe in which he is living and working? I think we are all in accord with the thesis that the vast body of known truth about our

surroundings, as revealed by the ways and the means of the physical and the biological sciences, is incomparably more wonderful and inspiring than the fiction of the most lively imagination and, being idealistic and non-materialistic in character, is of the imperishable treasures of the human race.

MEDALS OF THE NATIONAL ACADEMY OF SCIENCES

PRESENTATION OF THE AGASSIZ MEDAL FOR 1934 TO HAAKON HASBERG GRAN

WHETHER we ourselves be physicists, chemists or biologists, I think we will all agree, as living beings, that no question of sea science is more intriguing than how the inhabitants of the waters manage to survive in the waste of waters. And if we follow the life chain backward far enough we come at last to the question: What it is that governs the productivity of the sea for the microscopic floating vegetation which serves as eventual sustenance for all the animals of the sea? If all flesh be grass, it is as nearly true that all fish be diatoms. It is in this most significant field that Haakon Gran has delved, until his name and fame are as familiar to students of marine biology as is his genial countenance to many of us here.

Gran's earliest scientific papers were along somewhat other lines, for he opened his productive career as a student of the taxonomy and distribution of diatoms, a field in which he soon attained high eminence. He commenced his scientific authorship in the last years of the past century; in 1902 came his famous monograph on the plankton of the Norwegian sea, where he traced for the first time the relationship that the communities of floating plants bear to the various water masses through the seasons for so extensive an area. By 1908 he had produced his well-known handbook of the marine planktonic diatoms. In 1912 there followed what still remains the best-rounded account of the vegetable plankton of high seas that has appeared, based on his own field studies on the transatlantic expedition of the *Michael Sars*. And he has ever since continued adding to our factual knowledge of the microscopic plants of the oceans, far and wide.

All this, however, expresses but one side of Gran's scientific life. Even in his earliest papers, while a young student, we see him concerned with the sudden and spectacular increases and decreases in the amount of planktonic vegetation in northern seas, and with the wide variations that may exist in this respect within short distances, the occurrence of which was already well known, but for which no explanation had previously been suggested. Influenced, perhaps, by the Norwegian oceanographers Nansen and Helland-Hansen, he early saw that advances here, as in the physics of the sea, awaited the development of a precise quantitative technique. Experience followed with the centrifuge method, introduced shortly previous by Lohman, with such rich results. By 1912 Gran had combined this procedure with a satisfactory technique for preservation, and provided his fellow students with a tool, by means of which the whole water mass, top to bottom, can be as precisely examined for its content of microscopic plankton as for its temperature or for its salinity. Use of this tool far and wide, from seaside laboratory and deep-sea expedition, has vastly enlarged our knowledge of the quantitative distribution of planktonic organisms, and Gran has himself introduced it to American waters.

By that date Brandt's theoretic application, to the sea, of Liebig's law of the minimum, had been widely accepted as a working hypothesis, while Nathanson's suggestion that updrafts of chemically rich water from the deeps bring fertility to the surface zone where plants can live was exciting attention. These threads Gran drew together, showing that the seasonal cycle of plankton production in North-European seas is explicable only on the assumptions that variability in the chemical fertility of the water is in fact a controlling factor; that different water masses and depths do differ in this respect, and that the fertility of the surface waters alters from season to season.

Evidence for his far-reaching concept had so far been indirect, no adequate methods having been available for measuring the richness of the water in the substances presumably concerned. But the introduction by Atkins and Harvey of improved chemical technique brought ample confirmation for studies of the relationship between plankton and chemistry of the water, at many hands (including Gran's own), in different seas, it was soon proved that the picture outlined earlier by Gran and his associates was essentially correct; or, as Gran puts it, that "most of the differences in the productivity of various areas in the sea can be explained from the distribution of the nitrates and phosphates." So close, in fact, was the parallelism found between the ups and downs of the planktonic plants and of the nutrient substance most easily measured, and so attractive to the human mind is simplicity to account for complexity, that many of us were tempted to think we had found the uni-

versal cure-all for our perplexities. Chiefly to Gran and to his students do we owe our present realization that, though the underlying principle prevails, such simplicity never exists in the sea, but that the basic balance is everywhere confused by disturbing factors, in much more complex interaction. Most recently and in our own home waters Gran has shown how one particular type of oceanic circulation, highly favorable to plant growth when moderately developed, may be highly detrimental when too active.

Time does not allow me to speak of Gran's career in more detail. I can only mention his investigations of the causes for the fertilizing effect which land drainage appears to exercise upon the sea, his experiments on the total production of organic matter in sea water and on the cultural requirements of marine plants, though these have far-reaching implications.

But I hope I have said enough to show that the growth of knowledge of the fertility of the sea bears always the impress of Gran's guidance, in amassing facts, in developing hypotheses and in testing theory against observation with such sureness of vision that he now stands, acknowledged, a leader among students of the ocean. In this, he has done no small thing. It is for this that the Academy delights to honor him with this beautiful medal.

HENRY B. BIGELOW
WOODS HOLE OCEANOGRAPHIC INSTITUTE

PRESENTATION OF THE HENRY DRAPER MEDAL FOR 1934 TO JOHN STANLEY PLASKETT

IN 1872, Dr. Henry Draper, of New York, employing a small reflecting telescope he had himself constructed, secured the first successful photograph of a star's spectrum. Then with the advent of the far more sensitive dry plates this new method of learning of the chemistry and physics of the stars was to have a very fruitful development. Unfortunately, Dr. Draper did not live to realize how important was to become this new research field he had opened. But Mrs. Draper continued to be keenly interested and gave substantial encouragement to the new astrophysical studies which to-day bring us so much intimate knowledge of the stars. And so we have among other memorials the Henry Draper Fund of the National Academy of Sciences, which seeks to aid and encourage this branch of research. And it is my duty and pleasure to say a few words touching upon the academy's action in awarding this year the Henry Draper Medal to Dr. John Stanley Plaskett, director of the Dominion Astrophysical Observatory, Victoria, Canada.

Dr. Plaskett's life-work has been very closely in the field in which Dr. Draper was so prominent a pioneer.

Dr. Plaskett's consistent and fruitful program of stellar velocity observations, which he has conducted with exceptional skill and energy, and the important conclusions he and his colleagues have deduced from this rich observational material have afforded substantial scientific grounds for this award to him. Moreover, our medalist must be credited with outstanding success in another direction; for it was due to his foresight, conviction and diplomacy that the Canadian National Government became persuaded the people of Canada should have a large reflecting telescope. Thus the great Dominion Astrophysical Observatory—with its excellent 72-inch reflector—stands as a memorial to his vision and his steadfastness of purpose. Thus Dr. Plaskett has won a high standing and this splendid observatory has already developed traditions and a position of high repute among the world's leading observatories.

V. M. SLIPHER
LOWELL OBSERVATORY

PRESENTATION OF THE DANIEL GIRAUD ELLIOT MEDAL FOR 1932 TO JAMES P. CHAPIN

JAMES PAUL CHAPIN is one of those fortunate human beings who was born with that affinity for birds which characterizes the true bird-lover. The very term itself suggests the character of the relation that exists between a person so blest and the forms of life which so strongly attract him.

One never hears of a mammal-lover or a snake-lover, a fish-lover or even a butterfly-lover. But love of birds is as definite a heritage as that of the musician or the artist. This legacy, a gift perhaps from the remote ancestors to whose untutored minds birds were signs and symbols of the mysterious manifestations of nature, has been the dominant influence of Chapin's life. As a child it sent him to the fields and woods. As a boy of sixteen years it prompted him to enter the department of taxidermy of the American Museum of Natural History. There he acquired the technique of what was to become his profession. But he soon discovered that while a bird-lover is born the ornithologist is made, and the following year (1906) he entered Columbia University to acquire the general training and the broad knowledge of biology on which his studies of birds might be based.

In his junior year he left college to accompany the American Museum's expedition to the upper Congo, where he secured the most valuable and best-prepared collection of birds that has been made there, together with an unequalled knowledge of their habits.

Returning to New York benefited by his five and a half years' residence in the heart of darkest Africa, Chapin at once resumed his studies at Columbia, received his A.B. in 1916, his A.M. in 1917. In the

latter year he enlisted in the American army and served in France as zone major for the duration of the war.

After receiving his discharge from service, Chapin returned to Columbia for his doctorate and, escaping the lure of Drosophila, was given his Ph.D. for a thesis on his African bird studies, the only degree in ornithology that the university has granted.

There followed additional years of study before the publication of the book (the first of three volumes) for which Chapin is now honored.

The work of a man exceptionally qualified by desire, natural gifts and experience gained in nature, the museum and the classroom, it records in detail observations on habits and distribution, the result of prolonged field-work; it discusses questions of taxonomy and of nomenclature from the standpoint of the skilled systematist who has access to many specimens and is familiar with the literature of his subject, and it treats with the authority of the trained biologist those problems which arise in attempting to explain the relation of an animal to its environment.

Here, Mr. President, is an outline of the facts and factors which have induced the members of your committee to recommend the award of the Elliot Medal to James Paul Chapin.

FRANK M. CHAPMAN

AMERICAN MUSEUM
OF NATURAL HISTORY

PRESENTATION OF THE PUBLIC WELFARE MEDAL TO AUGUST VOLLMER

IT is a commonplace to-day to remark on the disparity between our knowledge and control of the physical forces of nature, and our knowledge and control of social forces.

Three centuries of scientific effort have won basic understandings of physical behavior, and have replaced superstition and appeal to authority by rational viewpoints. But it is vastly more difficult to make progress in the understanding of social forces, and the solution of social problems. Here prejudice is more deeply intrenched; selfishness and provincialism more completely determinant of mental attitude.

However great these difficulties may be, we have faith that surely, even if very slowly, knowledge and mastery are to be gained through the method that we term scientific.

To-night we honor a man whose service has been given to a social problem of critical importance in that difficult field, and who is applying to that problem the spirit and the technique of science.

Crime is a disease of society and August Vollmer a clinician who has stimulated the application to the problems of criminology and police administration of all that can be gathered from the realms of exact knowledge. His achievements have been noteworthy and of wide influence. They constitute, using the language of the purpose of the award of the Marcellus Hartley Medal, "eminent service to the public, performed without a view to great monetary gain, and by methods which are truly scientific."

Vollmer's work began and continued for many years in the police department of Berkeley, where, with but limited resources, pioneering demonstrations of scientific techniques were made. After a few years at Chicago, he returned to Berkeley, where now, as professor of police administration, he is engaged in the effort to bring the university's resources to the improvement of the administration of criminal justice.

By these years of effort, Vollmer has shown the way to the elimination of graft and spoils in police administration, has elevated the standards of personnel, and inspired his co-workers with pride in and ambition for their profession. He has stimulated the search of all fields of science to bring them to bear on the problems of crime detection and prevention. It is not too much to say that he has been instrumental in the veritable remoulding of a profession.

Such results bear testimony to Vollmer's qualities. He brought to his work persistence, intelligence and human sympathy without sentimentality. His unselfishness and modesty have been important factors in the acceptance of his demonstrations, and of his wide-spread influence.

These achievements in the difficult and once unpromising field of police administration have far-reaching results. Respect for law and order grows with the efficiency and character of their formal guardians, and every successful performance of a difficult function stimulates the faith and confidence of a people in its government.

MAX MASON

ROCKEFELLER FOUNDATION

ABSTRACTS OF PAPERS PRESENTED AT THE WASHINGTON MEETING OF THE NATIONAL ACADEMY OF SCIENCES

Lability of the basal metabolism of the dairy cow: FRANCIS G. BENEDICT AND ERNEST G. RITZMAN. The basal metabolism of five Holstein (ca. 600 kg.) and four Jersey (ca. 300 kg.) cows, ranging in age from 3 to 15 years, was measured in 24-hour periods on the fourth and fifth days after the withdrawal of food. At this

stage of fasting the respiratory quotients approached that of fat and the methane production was very low. Before their fasts the cows were fed for at least three weeks on maintenance or somewhat better than maintenance rations, consisting of roughages alone, concentrates alone or green grass (pasture). At no time were they undernourished. The roughages included six different hays, of varying protein content and of early and late cuttings. The concentrates given were either cornmeal alone or linseed meal supplemented by wheat bran. The cows were at all times kept at a controlled environmental temperature of about 20° C. In the majority of instances they were dry, in a few cases pregnant or lactating. The experimental series with any one animal extended from two months to one, two or (with two cows) three and one-half years. None of the cows underwent a change in body weight greater than 15 per cent., except in one instance, when the weight increased 28 per cent. within a year's time. The basal heat production per 500 kilograms of body weight, expressed on the basis of lying per 24 hours, varied from 10 per cent. with a dry cow (measured only twice) to 90 per cent. with two dry cows measured repeatedly over a period of several years. In eight instances with four cows (non-lactating) a marked change in fasting metabolism (either a decrease or an increase), amounting to from 30 to 85 per cent., occurred within two months, when there was no pronounced change in body weight and the animals could not possibly have altered appreciably in body composition. The greatest changes in metabolism occurred during lactation and especially with the change from hay to pasture feeding or *vice versa*. In view of the clearly demonstrated lability of the basal metabolism of these dairy cows the concept of constancy in basal metabolism of animals, which has prevailed among physiologists in general for so many years, must of necessity be revised and the possibility should be recognized that great changes in the endogenous metabolism may take place even within a relatively short time without concurrent changes in body weight.

Heat losses from the human body: EUGENE F. DU BOIS and JAMES D. HARDY. An analysis of the modes of losing heat from the body surface is important in understanding the mechanism for control of body temperature and the production of fever. Experiments carried on for the past twenty years by the Russell Sage Institute of Pathology with its calorimeter have eliminated much uncertainty as to the relation of the heat produced in the body to that eliminated from its surface and have carried the analysis of heat losses to the stage where it is known that under the standard experimental conditions about 24 per cent. of the heat lost is by means of vaporization of moisture. The development of an accurate instrument for the measurement of radiation permits us to estimate the amounts of heat lost through all channels. The proportions of heat lost by radiation, conduction and convection and vaporization are found to depend upon many factors. The physical factors include temperature of the air, of the walls of the chamber, humidity, air velocity, clothing and surface area exposed. Physiological factors include total heat production, vasomotor control and state of health. Measurements on a group of lightly clothed subjects while lying quietly in the calorimeter for periods of three hours show heat loss distributions as follows: Radiation 60 per cent., vaporization 25 per cent., convection 15 per cent. These proportions hold fairly well for clothed or unclothed subjects if the environmental temperature be kept between 77° F. (25° C.) and 81° F. (27° C.). Out of this range the effect of clothing is quite marked. Without clothes shivering usually occurs after several hours exposure to an environmental temperature below 75° F. and visible sweating at temperature above 82° F. The quantitative study of convection has explained several paradoxes and has thrown light on Rubner's law of surface area.

Some remarkable ciliate Protozoa from the caecum of the Indian elephant: C. A. KOFOID. The caecum of the Indian elephant contains two very remarkable new genera of commensal ciliate Protozoa named Polydinium and Elephantophilus. These new genera represent the highest level of evolution as yet discovered in the family Ophryoscolecidae, which includes many commensal species in the stomach of ruminants and in the caecum of other herbivorous mammals. *Elephantophilus zeta* has a Z-shaped macronucleus which, at division, reverts to the primitive club-shaped form found in *Polydinium mysoreum* and generally throughout the Ophryoscolecidæ. Both of these new genera have multiple spirally curved ciliary zones arranged in a secondary bilateral grouping instead of a single dorsal zone found elsewhere in some other genera of the family. There are five such zones in Polydinium and six in Elephantophilus. Prior to binary fission new ciliary zones are interpolated between the old. Multiple contractile vacuoles are distributed along these zones of motor activity in both genera. Prior to fission, new vacuoles arise along the new interpolated zones. These metameric structures and their adjacent excretory vacuoles provide a powerful spiral mechanism for boring locomotion through the comminuted vegetable contents of the caecum, among which they ceaselessly move and on whose cellulose fragments and other Protozoa and bacteria they feed. The evolution of structural complexity in the commensal protozoan fauna of herbivorous mammals has advanced along with that of their hosts.

Diabetes in relation with anterior hypophysis: W. G. MACCALLUM. Much experimental work bears upon the governing relation of the anterior hypophysis in the control of carbohydrate metabolism. Certain authors maintain the existence of a secretion neutralizing insulin, while others attempt to show that the hypophysis stimulates an outpouring of blood sugar by way of the adrenal medulla so that the essential is a balance between the activity of the islands of Langerhans and the adrenal medulla. A chart representing these relations is illus-

trated by the description of a case in which recovery from diabetes resulted from the establishment of a balance by the later atrophy of part of the anterior hypophysis.

Maternal influence upon longevity and upon the incidence of leukemia in mice: E. C. MACDOWELL (introduced by A. F. Blakeslee). In reciprocal matings between two highly inbred contrasting strains of mice, the average length of life in the first hybrid generation (683 *vs.* 545 days) differs by 138 ± 11.5 days, which is 12 times the probable error. The data behind these averages form frequency polygons of closely similar shape but with distinctly different ranges and with modes differing by three 50-day classes. Each sex of offspring alone gives similar results; no consistent sex difference in age is demonstrable. In one type of the cross 6 fathers and 17 mothers produced 166 young; in the reciprocal cross 11 fathers and 21 mothers produced 140 young. These two sets of F_1 hybrids also differ significantly in the incidence of spontaneous leukemia, as recently reported. The incidence of leukemia and length of life are inversely related; both vary toward the mothers' strain. While the incidence of leukemia in both directions of the cross lies between the parent strains, the age in both cases averages about 100 days above the mothers' strain; leukemic mice from the reciprocal matings differ as much in length of life as the non-leukemic mice. These results speak against a causal relationship between the two sets of observations. Reciprocal matings in a back cross give similar general results. Both length of life and incidence of leukemia differ significantly according as they are brought in from the grandmother by the father or the mother. Comparisons between the two hybrid generations showing groups with the same age and markedly different incidence of leukemia give further evidence of the physiological independence of these traits and indicate differences in the mode of transmission. Through the male line the incidence of leukemia in two hybrid generations shows a correlation with the total heredity from the leukemic strain; transmission through females raises this incidence. Longevity is also modified by maternal influence combined with marked heterosis and slight change in the corresponding matings in the back cross.

Oxygen consumption during Yogic breathing exercises: WALTER R. MILES and K. T. BEHANAN. Traditionally in the cult of Yoga special breathing routines have been used as a preliminary for mental concentration. The exercise types in question range from those composed chiefly of extremely rapid shallow breathing (two respirations per second) to those involving extremely deep and slow ventilation (one respiration per minute). Some of the learned breathing patterns are characteristically continued for 20 to 30 minutes preceding concentration. The present paper reports repeated metabolism experiments with three common Yogic patterns as practiced by a Hindu male (K. T. B.) of 31 years following a two-year period in the regimen of the Yoga cult. Each breathing pattern is found to produce a considerable rise in metabolic rate during the time (10 to 30 minutes) of the exercise. The effect on subsequent normal breathing appears to be transitory in two of the three types studied. In the case of the Bastrika pattern where shallow and deep breathing are alternated within each minute the after effect is more definitely prolonged and is in the direction of a reduced metabolism. A very slight increase in oxygen consumption is found in the experiments on mental concentration after normal quiet periods. The study suggests that artificial breathing patterns, if they influence mental concentration, do so probably more in psychological than in physiological terms.

Isolation from pancreas of a substance which inhibits trypsin digestion and its effect on the activation of trypsin: JOHN H. NORTHROP and M. KUNITZ. It has been known for nearly 100 years that the secretion from the pancreas possesses the property of digesting protein (meat). It has also been known that the secretion is inactive when it leaves the pancreas but becomes active upon entering the small intestine. The agent (enzyme) responsible for this digestive power was named "trypsin" by Kühne, but the chemical nature of this agent and the mechanism whereby it was activated have always been uncertain and controversial. The writers have isolated from fresh pancreas the active and inactive form of two proteolytic enzymes, trypsin and chymo-trypsin, and the activation of these pure compounds has been studied. In addition, the writers have recently isolated a crystalline material which is a compound of the enzyme, trypsin and another substance (inhibitor) of histone-like character which inactivates trypsin. It was found possible to split the compound into trypsin and inhibitor, and both components were then obtained in crystalline form. By combining the two components again the original compound may be synthesized and crystallized. Crude inactive trypsin solutions containing a trace of active enzyme become active when allowed to stand in neutral concentrated salt (magnesium or ammonium sulfate) solution. The purified crystalline inactive trypsin becomes active simply on standing in neutral solution without the addition of salt. When purified inhibitor is added to purified inactive trypsin the mixture behaves like the crude solution and does not become active until salt is added. The effect of salt upon the activation of crude inactive trypsin solutions, therefore, is to destroy the effect of the inhibitor. The transformation of the inactive to the active form of the enzyme is caused by the active enzyme itself. The experiment, therefore, represents the "propagation" of the active enzyme, since the addition of a small amount of active enzyme results in the production of a very large amount of "itself"; just as inoculating a culture media with bacteria results in the production of many more bacteria. The effect of the inhibitor is to inactivate the trypsin in the same way as an antiseptic would prevent multiplication of bacteria.

Some aspects of anesthesia and irritability: W. J. V. OSTERHOUT and S. E. HILL. Cells of the fresh-water plant *Nitella* respond to electrical stimulation like nerve

fibers but have the great advantage that each cell can be studied separately and is readily accessible to treatment with reagents. The irritability of the cell depends on a substance, or group of substances, which we may for convenience call *R*. This is shown by the fact that cells kept for 2 days in distilled water lose their irritability. The water in which cells have been standing contains substances which, when suitably concentrated and applied to the cell, quickly restore irritability. Such substances appear to be widely distributed, as might be expected in view of the general occurrence of irritability. For example, when irritability has been lost it can be restored in a few seconds by treatment with human blood. If the substances causing this effect are responsible for the irritability of nerve and lead to disturbances in nervous functions when deficient, such substances must play an important part in ontogeny and in phylogeny as well as in pathology. These experiments suggest that some anesthetics may produce their effects in the same way as distilled water, *i.e.*, by removing substances from the protoplasm. What is said of irritability applies also in general to the potassium effect, *i.e.*, the large *P.D.* (about 85 mv.) observed in leading off from a spot in contact with 0.01 *M* KCl to one in contact with 0.01 *M* NaCl. (In this respect the cell acts somewhat like a potassium electrode.) The loss of this property is an additional indication of the profound change in the protoplasmic surface caused by dissolving out *R*. What is the nature of *R*? One way of attacking this problem is to observe the effect of various pure substances. We find that the following can restore irritability or the potassium effect or both: NH_2, NH_4Cl, tetra ethyl ammonium chloride, guanidine, adrenaline and ephedrine. In some cases only one effect was secured and when both were obtained one was usually restored before the other. This indicates that they depend upon somewhat different conditions. It would not be surprising to find that a variety of substances are effective. We should expect that any substance capable of facilitating the breakdown of the non-aqueous protoplasmic surface under an applied *E.M.F.* would tend to restore irritability. Any substance which decreased the mobility of the sodium ion as compared to that of the potassium ion (*e.g.*, by forming complex ions) or which increased the concentration of potassium ions (*e.g.*, by chemical reaction) would probably tend to restore the potassium effect.

What are resting states and active states in chromatophores, particularly melanophores?: G. H. PARKER. In the past different investigators have expressed various views as to the resting state of Melanophores. Some have declared that the state with dispersed pigment is a resting state; others that the state with concentrated pigment is a resting one and still others that some intermediate state is that of rest. Experimental evidence shows that none of these views is correct. Any state of inaction, irrespective of the position of the pigment, is a resting state as contrasted with one of pigment movement which is an active state. In this respect Melanophores are like smooth muscle-fibers and unlike cross-striped muscle-fibers. The resting state of any Melanophore is ordinarily determined by its neuro-humoral environment.

Four theorems on the envelope of extremals: MARSTON MORSE.

Tauberian gap theorems: NORBERT WIENER.

Analysis of 18,000 proper motions derived at the Leander McCormick Observatory: P. VAN DE KAMP and A. N. VYSSOTSKY.

Observational evidence of an Einstein-red-shift in Class O stars: ROBERT J. TRUMPLER. According to Einstein's Generalized Theory of Relativity the gravitational field of the sun or the stars causes a slight increase in the wave-lengths of lines observed in the spectra of these bodies. The solar or stellar lines thus appear shifted toward the red as compared with similar lines of a laboratory source of light. This red shift is proportional to the mass of a star and inversely proportional to its diameter. For the sun it is small and difficult to verify, but in stars of small diameter or of large mass it becomes considerable. Stars of spectral Class O, which are of the highest temperature and the greatest luminosity, are known to be the most massive, and these stars were therefore selected for a test of the red shift. For stars in general the relativity shift of spectral lines can not be separated from the Doppler shift caused by their motion toward or away from the observer. Fortunately, many stars of Class O occur in galactic star clusters. Since the stars of such a cluster form a physical system, they must have nearly the same motion. The latter can be obtained from observations of the fainter cluster stars, for which the red shift is small because of smaller luminosity, lower temperature and smaller mass. The radial velocity observations of galactic star cluster which are in progress at the Lick Observatory are at present sufficiently complete to allow such a test in six clusters. The 9 Class O stars of great luminosity contained in these all show a decided positive excess of radial velocity for which there seems to be no other explanation but that of a relativity red shift. Its average amount is 10.8 km/sec or 17.1 times the shift predicted for the sun. An accurate numerical comparison with the theory is not possible because we do not know the masses of the individual stars; but if our interpretation of this effect is correct, we can use the observed red shift to determine the masses. The average value of 180 times the sun's mass thus obtained is somewhat larger than the rather uncertain value furnished by spectroscopic binaries. The difference is perhaps due to the particular selection of our stars, but the observed red shift is at least of the right order of magnitude.

Report on the progress of the Yale zone observations: FRANK SCHLESINGER. Yale Observatory has now completed the reobservation by photography of five of the Astronomische Gesellschaft Zones, embracing the positions of 40,980 stars. According to an agreement with the Astronomische Gesellschaft and with the Cape Obser-

vatory in South Africa, arrangements have now been made for covering the whole sky in this way. Yale's share in this work is the area between the equator and declination −30°, and this is being done on fields of 110 square degrees with a Ross camera. These zones have shown a general improvement in accuracy until now the weight of a star position is double that in our first zone.

Meningitis in man caused by a filterable virus: THOMAS M. RIVERS and T. F. MCNAIR SCOTT. To be printed in SCIENCE.

New endocrine complexes from recombinations of old breed types: C. R. STOCKARD.

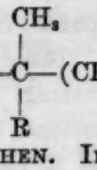
Significance of the amnion: GEORGE L. STREETER. In early stages of primate embryos, hitherto unavailable, it is found that the amnion is more closely related to the trophoblastic elements of the egg, in its origin, than to the cells that are to form the embryo proper. Thus embryologically it is a transitional structure, serving only during fetal life, and is to be grouped with the allantois, yolk-sac and placenta. In its development and later structure the amnion is essentially a serous membrane, functioning somewhat like the pleura and peritoneum. Containing more fluid than these, it provides the growing fetus with ample freedom for movement.

Relative importance of various genes to the organism: M. DEMEREC (introduced by A. F. Blakeslee). Present-day genetics visualizes the appearance of an organism as a result of the interaction of the whole complex of genes possessed by the organism and the environment in which that organism develops. Assuming that the environment is constant, the relative importance of the genes will be discussed here. The whole complex of genes forms a balanced system which is sensitive to various changes occurring in that system. The disbalance produced by such changes affects the organism and in many instances shows up as a new characteristic, usually detrimental to the organism. Studies with deficiencies, *viz.*, the material in which certain genes are missing, indicate that not all genes are of equal importance in the life of an organism. In the case of *Drosophila melanogaster*, where chromosomes are paired and each gene therefore is represented twice, the following categories of genes have been recognized. (1) If one gene of the two is missing it shows up as a detrimental characteristic on the organism; if both are missing the cell-lethal effect is produced, *viz.*, even a small group of cells of such constitution is unable to live (Notch, Minutes, Plexate). (2) If one gene is missing and the other is the wild-type allel the organism is not visibly affected, but if the other gene is a mutant allel the character is exaggerated; deficiency for both genes is cell-lethal (forked, tan, sable, tiny, rudimentary). (3) Deficiency for one gene has no effect on the organism, deficiency for both is cell-lethal (dusky, miniature, fused). (4) Deficiency for both genes is not cell-lethal, but is lethal to the whole organism (cut, yellow, scute). (5) Presence of the gene is detrimental and its absence beneficial to the organism (Bar).

The mechanism of sexual reproduction in Neurospora and Gelasinospora: B. O. DODGE. In normally bisexual races of *Neurospora* the ascogonium is quickly surrounded with a weft of sterile tissue. Spermatization, or conidiation, is not necessary and no trichogynes are formed when the ascogonium is provided with nuclei of opposite sex-reaction from the beginning. There is no pause in the development of the ascocarp. When unisexual mycelia are grown separately the same type of incipient perithecium is formed, but after it has reached a certain size trichogynous elements grow out through the sterile envelope. No further growth occurs unless microspores or monilioid conidia of the other sex-reaction come in contact with these receptive elements. If this occurs fertilization follows and the ascocarp matures. It will be shown that when unisexual races of opposite sex are grown together from opposite sides of a plate culture there is a more effective method of bringing the two kinds of nuclei together. This feature also determines the perithecium distribution pattern so characteristic of many pairs of races. *Gelasinospora tetrasperma* does not produce spermatia or other asexual reproductive bodies, yet fertilization occurs readily in mixed cultures of facultatively heterothallic races. The way this is brought about will be described.

The genetic control of developmental relationships and its bearing on the theory of gene action: E. W. SINNOTT (introduced by R. A. Harper). It has been shown that fruit shape in Cucurbita is controlled by a series of genetic factors and that these produce their effects independently of the size of the organ. They evidently control relative rather than absolute growth. When F_2 shape indices are plotted arithmetically they show marked positive skewness, which disappears in logarithmic plotting, indicating that the genic effect is an exponential rather than an additive one. Other dimensional relationships in the fruit behave similarly. Widely diverse shape types can be derived graphically from a basic type by plotting it in a series of logarithmic coordinates of various sizes, and the series of fruit patterns thus seems to be the result of modifications of an axial exponential gradient. A genic control of the steepness of this gradient would account for most of the shape differences observed. Simple quantitative traits like fruit weight show a similar skewness in F_2 (though often not in environmental variability) and it may be that here, also, it is developmental relationships of various sorts, rather than absolute quantities, which genes determine. This is further suggested by the fact that size differences are found to be due to differences in the relative extent of various aspects of the developmental schedule, notably, cell division and cell enlargement. It is suggested that in all inherited traits the relationships between rates rather than the absolute rates themselves are what genes control.

Old and new criteria for determining the relationships of higher plants: WALTER T. SWINGLE.

Analysis of rotatory dispersion curves of members of homologous series of the type  .

P. A. LEVENE AND ALEXANDER ROTHEN. In the above formula n=0 or an integer, R=a normal alkyl or an aryl group, X=a functional group. When n=0, on substitution of X by Y, depending upon external conditions, one of two stereoisomeric substances may form. Neither one's configuration can be determined by direct chemical means. When n=1 or an integer, then only one isomer can be formed, inasmuch as no inversion takes place during the reaction of substitution. Through the analysis of the rotatory dispersion curves it is possible to determine in each case the partial rotations of X and of the rest of the molecule. In the case when n=an integer, it was found that on substitution of X by Y or Z, or some other atom or group, the change in rotation is independent of the value of n. On the basis of the analysis of the events following the substitution of X by Y in this group of substances, it was attempted to predict the result of the reaction in the cases when n=0.

The oxygen equilibrium of hemoglobin and its structural interpretation: LINUS PAULING. It is shown that the data on the oxygen equilibrium of hemoglobin indicate that the four hemes of the molecule are arranged at the corners of a square; each heme is connected with two others in such a way as to give rise to an interaction energy of 1,500 cal./mole for each pair of adjacent oxyhemes, and each heme contains two acid groups, the interaction energy of each with the oxyheme being 820 cal./mole. It seems probable that the hemochromogens differ from hemoglobin mainly in that in the hemochromogens the hemes are independent and in hemoglobin four hemes form a conjugated system.

Some physical properties of rubber prepared by fractionation and crystallization: W. HAROLD SMITH (introduced by W. W. Coblentz). A method of preparing pure rubber hydrocarbon from *Hevea latex* aims to preserve intact its physical structure. The purified rubber is separated into two fractions by ethyl ether. Approximately 75 per cent. is soluble. Each fraction yields crystals which differ in their melting behavior. The stress-strain characteristics of vulcanized fractions and x-ray diffraction data indicate other differences. The molecular weight of the soluble fraction is much greater than any value which has ever been reported for total rubber.

Quadratic wave equation—flood waves in a channel with quadratic friction: M. A. BIOT (introduced by C. A. Adams). A mathematical investigation is here made of what happens in a channel or a river in the case of the bursting of a dam. When the retaining wall of a water reservoir suddenly gives way, a flood wave propagates in the channel with a constant speed. The height of the wave varies all the time and decreases according to a certain law.

Electrical communications, past, present and future: FRANK B. JEWETT.

X-ray wave-lengths and the fundamental constants: J. A. BEARDEN (introduced by R. W. Wood). The scale of x-ray wave-lengths has been obtained by three independent methods. (1) A plane grating (ruled by Professor R. W. Wood) 75 mm long ruled with 100 lines per mm has been used in an ionization double crystal spectrometer to measure the wave-length of the copper $K\alpha_1$ line. These results are in good agreement with the author's 1931 photographic ruled grating measurements. (2) X-ray refraction measurements using a diamond prism have been made within an accuracy of 1 part in 10,000 and the x-ray wave-lengths obtained agree with the ruled grating results. (3) Larsson has used a 5 meter concave grating to compare the high orders of the Al $K\alpha_{1,2}$ line with the first order of a known spark line. These results are also in agreement with those of (1) and (2). Thus the absolute wave-length of x-ray lines is now known to within 1 part in 10,000. Since there is no evidence that would indicate the existence of a mosaic structure in crystals normally used for x-ray work, and since many crystals have been found that fulfil the theoretical requirements of a perfect crystal, one should be justified in using the absolute x-ray data for calculating Avogadro's number N. Such a calculation gives $N=6.022\times10^{23}$ mol. per mol. Then by the use of the Faraday constant we can get the charge on the electron or $e=4.803\times10^{-10}$ e.s.u. This result is 0.75 per cent. higher than is obtained from the oil drop experiment. Planck's constant h as obtained from the high frequency limit of the continuous x-ray spectrum is increased to $h=6.608\times10^{-27}$ erg. sec.

Spectroscopic investigations in the extreme ultra-violet: K. T. COMPTON and J. C. BOYCE. The Carnegie Institution of Washington vacuum spectrograph, which is located in the spectroscopy laboratory of the Massachusetts Institute of Technology, provides sufficient dispersion and resolving power, over a broad range, to make possible a considerable program of spectroscopic research in the extreme ultra-violet. The instrument has already been used on a number of investigations of emission spectra of atoms and of molecules, and of absorption spectra of molecules, some of which have already been published. Among the more recent and unpublished results of the group of workers collaborating in the use of this spectrograph are those which revise and extend the term analysis of argon, krypton and phosphorus. In argon, de Bruin's term assignments for A II have been somewhat revised, additional triplet terms in A III have been discovered, and a start has been made on the doublet system in A IV.

A model of atomic nuclei: WILLIAM V. HOUSTON.

A new type of excitation function for nuclear reactions: E. O. LAWRENCE, EDWIN MCMILLAN and R. L. THORNTON. The voltage excitation functions for the

reactions in which radioactive Na^{24} and Al^{28} are formed from sodium and aluminum by deuteron bombardment have been investigated up to a deuteron energy of 3.3 Mv. These results show a type of behavior quite different from that to be expected on the basis of the Gamow theory of nuclear penetration. The differential excitation curves, plotted against the deuteron range, start to rise appreciably at about 1.0 Mv, build up exponentially to about 1.8 Mv,[1] and then become linear and remain so to the highest energy of 3.3 Mv. A sharp contrast thus exists between the experimental results and Gamow's formula, since the latter predicts a rapidly increasing slope over the whole energy range. It was also found that deuteron bombardment caused radioactivity in copper, an element of surprisingly high atomic number for such an effect. The radioactive product has a half life of 6 hours and is presumably the copper isotope also formed by neutron bombardment. The excitation curve in this case starts at 1.5 Mv, and is still increasing in slope at 2.8 Mv, but not nearly as rapidly as predicted by the Gamow theory. A theoretical interpretation of these results has now been found by J. R. Oppenheimer.[2] The reactions mentioned above are all of the type in which a deuteron gives up its neutron to a nucleus. If this involves the entry of the whole deuteron into the nucleus, the Gamow theory should hold; but a process is also possible in which, while the deuteron is just outside a nucleus, the neutron leaks through the potential barrier separating its normal state in the deuteron from a bound state in the nucleus. This barrier is in general much more penetrable than that opposing the entry of the whole deuteron. The numerical consequences of this theoretical picture have been worked out by Professor Oppenheimer and Dr. M. Phillips for the cases described above. The form of the resulting curves depends on the value assumed for the binding energy of the neutron. An extremely good fit with the experimental curves in all three cases is given by his formula with the binding energy taken as 1.7 Mv; values differing from this by 0.9 Mv give curves in gross disagreement with the experimental results. It thus appears that the present results and their theoretical interpretation offer a new method of evaluating the binding energy of the deuteron and hence the mass of the neutron. The values thus obtained are very near to those now accepted.

Further experiments on the cosmic ray longitude effect: ROBERT A. MILLIKAN and H. VICTOR NEHER.

Exact solutions of wave diffraction and scattering problems in elliptic and spheroidal coordinates: PHILIP M. MORSE (introduced by John C. Slater). The solutions of the wave equation in spheroidal and elliptic cylinder coordinates, discussed by Stratton in the preceding paper, have been computed, in part by the differential analyzer, and tabulated. These tables, together with the addition formulae expressing the plane wave in terms of the spheroidal functions (see Morse, *Proc. Nat. Acad.*, 21: 56, 1935) make it possible to obtain exact solutions of a large number of diffraction and scattering problems. As an example of the method, the scattering of a plane wave by a long, perfectly reflecting ribbon of width d and the diffraction of a plane wave by a slit of width d have been computed for a range of wave-lengths of the order of magnitude of d, for different angles of incidence and for different boundary conditions. The problems are related by Babinet's theorem. The resulting curves evidence interesting resonance effects when the wave-length equals d or 2d. The results of the scattering problem are useful in a study of the acoustical properties of ribbon microphones and loud speakers. Other problems which can be solved exactly by the use of the tables are the scattering of waves (sound, light or electron) by prolate spheroids or by round disks, the radiation of waves from these objects and the diffraction of waves by circular apertures.

On the fundamental equations of elasticity, with special reference to the behavior of solids and liquids under extreme pressures: F. D. MURNAGHAN (introduced by Joseph S. Ames). Formulae are derived for the components of the stress tensor in terms of the energy of deformation and its derivatives with respect to the components of the strain tensor (the latter being referred to the strained position of the medium), without making the usual assumption that the deformation is infinitesimal. As a special result it turns out that for media under uniform (hydrostatic) pressure p is a function of the quantity $e = \left(\frac{V_0}{V}\right)^{2/3} - 1$. On testing the cubic expression $p = ae + be^2 + ce^3$ on recent experimental results of Bridgman on lithium, sodium and potassium with a pressure range of 2,000 to 20,000 atmospheres (the constants a, b, c being determined by the values at 2,000, 10,000 and 20,000 atmospheres) the theoretical formula agrees, over the entire range, with the experimental results to within one half of 1 per cent. For liquids (n-amyl iodide and n-butyl iodide) over a range of 500 to 12,000 atmospheres there was agreement to within 2 per cent. (all but four out of some fifty calculated values being within 1 per cent. of the observed values). The values of the constants for the solids were: *Lithium:* $a = 179.11 \times 10^3$; $b = 140.0 \times 10^3$; $c = 145 \times 10^4$; *Sodium:* $a = 94.13 \times 10^3$; $b = 251.8 \times 10^3$; $c = 47 \times 10^3$; *Potassium:* $a = 44.81 \times 10^3$; $b = 124.72 \times 10^3$; $c = 142.5 \times 10^3$.

The width of spectrum lines: F. K. RICHTMYER and E. RAMBERG. According to classical theory the observed width of spectrum lines depends on (1) the Doppler effect due to the thermal motion of the emitting atoms; (2) interruptions of the vibrating mechanisms by collisions with other atoms; and (3) radiation damping, the greater the damping the wider the line. In the optical

[1] These curves had been examined previously to 1.9 Mv. (E. O. Lawrence, *Phys. Rev.*, 47: 17, 1935; E. M. McMillan and E. O. Lawrence, *Phys. Rev.*, 47: 343, 1935). In this voltage range the observed deviation from the Gamow formula was so slight that it was not considered significant at that time.

[2] We are much indebted to Professor Oppenheimer for his valuable cooperation in this work.

region (3) is very small compared to (1) and (2). In the x-ray region (1) and (2) are negligible compared to (3), which is large enough to permit measurements of widths. Such measurements, however, show that x-ray lines are, in general, much wider than would be expected from (3). This is explained on the quantum theory as follows. In the quantum theory, radiation damping is replaced by "mean life" of the atom in a given excited state, the shorter the mean life, the greater the effective width of the state. The mean life is determined not only by the radiation transitions between states (corresponding to radiation damping) but by the probability of radiationless transitions (Auger effects). Quantum mechanical calculations show that the widths of a large number of the excited states, and hence of the spectrum lines resulting from transitions between states, are due in large part to Auger effects. There is qualitative agreement between the computed and the observed widths.

Intensities of x-ray satellites: ANNA W. PEARSALL (introduced by F. K. Richtmyer). After a brief survey of the bearing of the problem of the intensities of x-ray satellites on the origin of x-ray spectra, a résumé is given of previous measurements of satellite intensities, particularly those associated with the L-series spectral lines. The present paper reports measurements on the intensities of the satellites accompanying the strong K-series lines, $K\alpha_1$ and $K\alpha_2$. These data are the more important because of the recently published theory of Coster and Kronig (*Physica*, II, 13, 1935) concerning the relation of the Auger effect to the origin of satellites. Since the type of Auger effect discussed by Coster and Kronig can play no part in the origin of K satellites, it might be expected that the variation of their intensities with atomic number would obey a very different law from that applicable in the case of L satellites. Using a Siegbahn vacuum spectrograph, spectrum plates were made of the $K\alpha$ lines with accompanying satellites $K\alpha_{3,4}$ for elements in the atomic number range S(16) to Cu(29) inclusive. From microphotometric records of these plates, intensities of $K\alpha_{3,4}$ relative to $K\alpha_1$ were obtained. These intensities vary from 0.7 per cent. for Cu(29) to some 3 per cent. or 4 per cent. for Cl(17) and K(19). No sharp maximum of intensity similar to that found with the L satellites was observed.

The ancestral tree of the Proboscidea. Discovery, evolution, migration and extinction over a 50,000,000 year period: HENRY FAIRFIELD OSBORN. Ancestral Titanothere tree embraces 15 phyla extending over 20,000,000 years, Lower Eocene to Lower Oligocene; exhibits independent origin and evolution of bony horns, independently arising as "aristogenes." Proboscidea exhibit 30 independent lines of descent, extending over period of 50,000,000 years; superior tusks take the place of horns. In contrast to arrested evolution of titanothere grinding teeth, Proboscidea exhibit 30 distinct lines of evolution in the grinding teeth coordinated with special adaptations of either superior or inferior tusks; adapted to variations of herbivorous diet ranging from arctic to equatorial conditions in all continents except Australia. Aristogenesis can now be measured as to secular rate of evolution. It is in widest possible contrast with the D. mutations. Aristogenesis in the origin of the cones of the grinding teeth is in accord with 18 principles, namely: Every single aristogene obeys the eighteen principles of biomechanical adaptation; it has its own individual and particulate adaptive history; it is coordinated with the functions and adaptations of the organism as a whole; its survival and relative strength or its reduction and elimination is determined by its degrees of service. Evolution of proportion (Alloiometrons) is in contrast with Aristogenesis and follows two principles, namely: (1) Irrespective of remote ancestry and remote phylogenetic affinity, closely similar adaptive changes of proportion in the cranium and in the segments of the limbs arise in different lines of mammalian and reptilian descent. (2) Convergent alloiometrons in the limbs, cranium and grinding teeth arise as relatively rapid secular changes following adaptive radiation in habit and function. They are most strongly convergent where there are the most intense similarities in the geographic and geologic environment. Alloiometrons are extremely rapid and entirely independent of ancestral hereditary influence; that is, similar changes of proportion may occur in the limbs of dinosaurs and of mammals. Aristogenes (*e.g.*, horns of titanotheres, dental cones of proboscideans) are absolutely dependent upon ancestral heredity and arise only in long periods of geologic time. The author's thirty-four-year research on the evolution of Titanotheres and Proboscidea yield all the known modes and principles of the origin of species as defined by biomechanical characters.

The change in the range of accommodation with age and its connection with the length of life: FELIX BERNSTEIN (introduced by Franz Boas). A systematic study of the inheritance of the duration of life is difficult because death is due to accidental as well as to natural causes. Therefore, I tried to substitute the study of the heredity of the span of life by the study of the physiological aging of the organs of the body. The easiest measurement in that respect is that of the change in the elasticity of the lens of the human eye manifested in the loss of the power of refraction with age which becomes apparent as a defect during middle age (presbyopia). Data on 5,000 cases of presbyopia gathered from the university clinics of Goettingen and Leipzig and from two private oculists, and followed individually from the first tests until death, proved that presbyopia is correlated with the duration of life in such a way that the early presbyopes die early and the late presbyopes die late. This whole correlation applied only to those who died from brainstroke and heartstroke, constituting about half of the material. The other half, who died of pneumonia, diabetes, cancer and other diseases, were not at all or only slightly correlated. By classifying the data in three classes, normal, sub-normal and super-normal presbyopia, we found, for instance, that the expectation of life length in the three classes at

the age of 50 amounted to more than eleven years difference between the highest and lowest class of those who died of arteriosclerosis. During the summer and fall of 1933, family data on the range of accommodation have been collected with the aid of a grant from the Rockefeller Foundation given to the Biological Laboratory at Cold Spring Harbor. In order to compare the data of different ages, all persons were reduced to a normal age taking in account the development of the range of accommodation as determined by the whole material. We compared the standard deviation of the range of accommodation among the members of the same family from the family mean with the standard deviation of all individuals from the mean of the whole material. The average square of the deviation from the general mean was 9.97; on the other hand, the average square of the deviation from the family mean was only 3.58. This shows conclusively that the physiological aging measured by the range of accommodation is essentially hereditary. In the year 1934–35 the data of 95 families were collected in Jersey City, N. J. From these the square of the standard deviation of the members of the family from the family mean amounted to 2.9; the square of the standard deviation of the whole population from the general mean amounted to 8.7. This result confirms the previous conclusions. The investigations do not indicate any sexual difference in regard to the range of accommodation. The fact that women actually live one year longer on the average than men, therefore, is not due to hereditary causes, but is due to the differences in the conditions of life in both sexes. These implications of natural span of life are especially important in regard to the fact that the natural causes of death come more in the foreground the more the infectious diseases are brought under control.

The tempo of growth of fraternities: FRANZ BOAS. Previous investigation has shown that the tempo of development from six years to adult life must be considered as a unit so that children who at six years are developing rapidly will continue to do so and reach adult life more quickly than those who at six years are retarded. A study of the growth curves of brothers and sisters of rapidly developing children shows that these also will develop rapidly and that the brothers and sisters of those retarded will develop slowly. The tempo of development must therefore be considered as in part determined by heredity. At the same time the influence of environment must be recognized. The average dates of maturity of Hebrew and Northwest European girls, both in private schools and in orphan asylums, are practically the same, namely, 12 years and 5 months, while Negro girls in orphan asylums, on the average, mature 6 months earlier. The influence of environment upon bodily form is also expressed in a comparison between the statures of immigrants and their descendants. It is well known that stature in Europe has been constantly increasing. The stature of immigrants, on the other hand, between 1860 and 1920 has remained constant, while the stature of their American-born children has been constantly increasing. In 1910 I showed that the cephalic index of immigrant Hebrews was on the average 83.0, that of their descendants born in the United States 81.4. Children of Hebrew mothers born in the United States had an index of 79.7. At that time families in which both parents were native born were difficult to find. Measurements made by Dr. Nicolai Michelson during this winter gave an index for children of native-born Hebrews of 78.7.

The neural basis of memory in primates: C. F. JACOBSEN (introduced by Robert M. Yerkes). Two basic types of modification of behavior through experience have been distinguished: (1) Modification of response which does not suggest any change in the innate connections between receptor and effector mechanisms (progression of physiological states), and (2) modification which implies a change in the pattern of connections between receptors and effectors (associative memory, conditioned reflexes). The latter kind has been regarded as the type of all true learning, and efforts have been made to describe complex behavior as combinations of simple associations. According to this view the concept of learning and memory embraces a unitary process. However, distinctions have been made between various forms of memory—motor habits, associative memory, conditioned reflexes, logical memory and reproductive memory or recall. These distinctions rest largely upon differences in the stimulus-response relations involved, and it has often been assumed that the variety of phenomena resulted from different methods of study. But this array of phenomena justifies raising the question whether the concept of memory can be studied as a unitary process or whether it comprehends phenomena having no common organic basis. In this paper evidence will be presented that memory embraces qualitatively different phenomena mediated by different neurological mechanisms. In the investigation of the neural basis of memory, monkeys and chimpanzees were tested on a battery of behavioral problems, subjected to surgical lesions of the cerebral cortex, and examined for deficits in the abilities measured before operation. The tests ranged from simple conditioned reflex situations to complex "insight" problems, and included tests of instrumentation, delayed response, sensory-motor habits and visual discrimination. Complete bilateral extirpation of the frontal association areas caused failure on those problems which required some capacity for reproductive memory. Injury to the frontal areas not only caused amnesia for previous acquisitions of this kind, but produced a permanent loss as evidenced by failure to improve with extensive reeducation. On the other hand, the subjects which exhibited profound deterioration of reproductive memory suffered no amnesia for discrimination habits and problem box solutions and showed no retardation in the acquisition of new habits of a similar nature. Control observations indicate that this impairment of recall can not be attributed merely to an extensive injury to the cortex, since lesions in the temporal, parietal and motor regions caused no deterioration of this function. Lesions of the frontal cortex cause not general weakening of memory but only

deterioration of a special form of memory. It thus seems that the various phenomena of learning and memory can not be regarded merely as different aspects of an essentially unitary process. On the contrary, the concept of learning and memory is seen to comprehend at least two, and probably more, diverse processes which are mediated by different neurological mechanisms.

A habitation site and workshop attributable to so-called Folsom Man: FRANK H. H. ROBERTS, JR. (introduced by John R. Swanton). A significant addition to the material illustrating an early phase of aboriginal American culture was obtained during October and November, 1934, in northern Colorado, where indications of a camp site and workshop attributable to so-called Folsom Man were brought to light. A whole series of stone implements—several types of scrapers, a variety of cutting edges, drills, engraving tools—and numerous examples of the characteristic point identified by the name Folsom were found in situ in a dark layer of earth 14 feet below the present ground level. The layer, which was exposed in the side of a deep and narrow gully, also contained quantities of cut and broken animal bones, stone chips and flakes resulting from the manufacture of tools, charcoal and ashes, and other refuse such as accumulates around habitations. The concentration undoubtedly was a midden, and remains of dwellings probably are nearby. Whereas the only traces of a presumably early hunting people prior to this find were typical finely chipped points of stone, there is now a definite complex of associated implements. In addition the scrap flakes give evidence of the technique employed in the manufacture of implements, and the spalls and nodules indicate that the stone-working was done on the spot. Raw material suitable for making tools is plentiful in the neighborhood. The points which became the pattern for the type were found by a party from the Colorado Museum of Natural History in 1927 near the small town of Folsom, New Mexico, hence the name. They were in association with skeletons of an extinct species of bison, one which is considered as having lived at the close of the glacial period. Since then other points of that type have been found at different localities along with bones of another extinct species of bison, of an unidentified musk-ox like creature, and of the mammoth. The supposition that the type represents considerable antiquity rests upon these associations. Whether the finds actually date man in North America at the beginning of the post-glacial period or demonstrate a later survival of Pleistocene animals is a phase of the problem which the geologist and paleontologist must solve. Archeologists generally concede that the Folsom points belong to the earliest phase of aboriginal American culture yet discovered. The main importance of the Colorado find lies in the fact that for the first time a variety of implements has been obtained for that horizon. The site was originally discovered by Judge C. C. Coffin and his son, A. L. Coffin. It was brought to the attention of the Smithsonian Institution by Major Roy G. Coffin, of Colorado State College, Ft. Collins.

Event classifications in Navaho, a study in linguistic psychology: E. SAPIR. Any "event" may, for purposes of linguistic reference, be classified from various points of view. A number of such points of view, applying to the Navaho verb, are briefly summarized in this paper. The complex formal system of the Navaho verb can be functionally analyzed from five points of view: 1, voice; 2, person (including number); 3, state ("neuter" and "active"); 4, tense-mode; and 5, aspect (*e.g.*, momentaneous, continuative, repetitive). In many ways these Navaho classifications come closer to a freshly objective view of the nature of events than do those of such languages as English or Latin.

Some reactions of Mongolians and Caucasians in an emotional situation: G. M. STRATTON and FRANKLIN M. HENRY. Chinese and Japanese, together with Americans of the Caucasian race—about fifty persons of each of these three kinds; about 150 persons in all—were placed singly in a laboratory situation aimed to be at least mildly stirring. And the conditions were such that the slight stir of emotion might not have an obviously different association with the different ancestral cultures involved. It, however, is not claimed that the influence of racial culture has been completely excluded. A large and heavy wooden hammer, about six feet long and mechanically controlled, was watched by the subject as it fell from a considerable height and struck a resounding blow close to his outstretched hand. There were instrumental records of the involuntary movement of the hand, together with records of changes in the breathing, pulse rate, blood pressure and the electrical resistance of the skin. The present report is concerned only with the movement of the hand. In this both the Chinese subjects and the Japanese subjects, in the average of their reactions, appear to be significantly different from the Caucasian subjects, giving smaller reactions than do the Caucasians; while the Chinese subjects and the Japanese do not, on the whole, seem significantly different from each other.

Biographical memoir of Edward Sylvester Morse: L. O. HOWARD.

Biographical memoir of George Perkins Merrill: WALDEMAR LINDGREN.

Biographical memoir of Edward Wight Washburn: W. A. NOYES.

Second report on the physical studies of the members of the National Academy: ALEŠ HRDLIČKA. Final report on the speaker's measurements and observations on 150 members of the National Academy, 100 of which were old Americans (all members of whose families were American born for at least three generations), 50 European-born or of more recent American derivation. The studies were complicated by the somewhat small numbers of the subjects and the advanced age of many of the members; nevertheless a number of interesting points came out quite clearly. The outstanding results are as follows: (1) The two classes of members showed unexpected general similarity, differing only in certain few characters (cephalic index, some facial dimensions, etc.). (2) The membership as a whole rep-

resents in every respect a remarkably normal group, above the average of the general population. (3) The members in whom the body proportions have not yet suffered notably from senility, in both groups, show tall stature, higher than even that of the old Americans at large. (4) The head in the academicians, both groups again, is both absolutely and relatively to stature distinctly larger than that in the general American population; and the increase is especially in the breadth of the head, which raises somewhat the cephalic index. (5) All the facial features, particularly in the old American members, tend towards reduction. (6) The chest in the members of both groups is spacious and especially deep. (7) In pigmentation the members of the academy show absence of pronounced blonds, absence of marked reds and frequency of dark hair (though now mostly gray). The total of the results indicates that, barring rare exceptions, the membership of the academy represents not only mentally but also physically a select group.

(To be continued)

OBITUARY

DAVID GRIFFITHS

BORN at Aberystwith, Wales, on August 16, 1867, son of David and Rachel (Lewis) Griffiths, he died at Emergency Hospital, in Washington, D. C., on March 19, 1935.

He came to the United States with the family when about three years of age, settling on a farm in South Dakota, his early education being in the local schools, including Groton, S. Dak., Academy and Aberdeen, S. Dak., High School. Having taken a general scientific course, majoring in botany, he was graduated from the South Dakota Agricultural College in 1892, receiving his M.S. in 1893. During his attendance in college he taught school in winters, and from 1893 to 1898 taught biology, physics and chemistry in the Aberdeen, S. Dak., High School. Specializing in botany and zoology at Columbia University, he received his Ph.D. in 1900. At this time he was interested in the study of fungi, publishing contributions on powdery mildews, smuts, ergots and others in *Asa Gray Bulletin, Torrey Botanical Club Bulletin* and elsewhere.

He was professor of botany and botanist of the Experiment Station of the University of Arizona in 1900–01, there beginning the studies of grasses and other range plants and range management which continued through the first fifteen years of his service in the Federal Bureau of Plant Industry, which he entered in 1901 as expert in charge of field management in the Office of Grass and Forage Plant Investigations. This work involved extensive travel and field studies of native pasture grasses, salt bushes and cacti, from the Canadian border southward well into Mexico. These studies resulted in numerous department publications in which, along with other conclusions of scientific interest and practical importance, the imperative necessity for avoidance of overstocking the ranges with resultant depletion of plant cover and destructive erosion was emphasized. In these studies he became impressed with the economic importance of the cacti as forage plants, and through utilization of native stands and experimental plantings in Texas and California established the usefulness of some of these as emergency forage reserves to tide over drouth shortages. His published results of experiments with "spineless" prickly pear constituted the most important stabilizing factor during the extravagantly optimistic exploitation of this plant which occurred during the first decade of the present century, and served effectively to warn the public against the indiscriminate extensive planting of the spineless forms in climates to which they are not adapted because of their susceptibility to injury by cold.

Appreciating the possibilities of cacti as ornamental plants, he early assembled a comprehensive collection of species and varieties at the Plant Introduction Garden at Chico, Calif., which afforded material for the preparation of a fine collection of colored illustrations, unfortunately as yet unpublished. Close to 3,500 numbers of Opuntia were included in the Chico collection. From these experimental studies of the cacti resulted a steady flow of papers on taxonomic, agronomic and horticultural phases, published by the Department of Agriculture, the Missouri Botanical Garden, with which close cooperation existed, and in various scientific and popular journals from 1905 to about 1920. These materially enlarged available knowledge of cacti and were of particular importance because of their timeliness in relation to the development of the wide-spread and intensive interest in them as agricultural and horticultural plants.

His steadily increasing interest in the horticultural field resulted in his eventual assignment to the bulb production project of the Bureau of Plant Industry, to which approximately his last twenty years were devoted. Some preliminary experimentation in the commercial production of Dutch bulbs, in distinction from the flowering of the imported bulbs both out of doors and under glass, had previously been done, with results which indicated probability of developing satisfactory production of some species. Economic conditions differed so widely from those in the European countries from which the imported supply came, and the lack of training and experience in the art of bulb growing

among American growers was so obvious that the pioneering of the industry along lines technically efficient and economically sound was a difficult undertaking. Though the funds available were woefully inadequate for the purpose, Dr. Griffiths entered the field with such enthusiasm of spirit and tenacity of purpose, and so promptly devised scientifically sound and practical methods of procedure that he soon became recognized as the unquestioned leader in this field. Maintaining experimental plots and to some extent variety collections at Arlington Farm, Va., Bellingham, Wash., Willard, N. C., and cooperative tests with interested amateurs and commercial growers in many sections, his leadership was largely responsible for the progress thus far made in commercial bulb production in the United States.

Even as senior horticulturist much of his field work was of necessity done with his own hands, frequently under weather and soil conditions which involved physical hardship and hazard to health which would have discouraged one less resolutely persistent and determined to carry through the undertaking. His sustained enthusiasm and courage under such conditions inspired loyalty in his assistants and encouraged them to do their very best.

Dr. Griffiths' most extensive and immediately important bulb work from the economic standpoint dealt with the devising of practical methods of growing and handling the bulbs of narcissi, tulip, hyacinth, as well as Easter, Madonna, Henry, Speciosum and Tiger lilies and other already widely grown and extensively imported Dutch bulbs, upon most of which he published extensively and usefully through the Department of Agriculture. He was at the same time intensively interested in the newer and less well-known bulbous plants, notably the Regal, Nankeen and other foreign lilies, and especially in such potentially important lilies as the Leopard, Lemon, Humboldt, Columbia, Martagon, Turk's-cap, Canada and other native species. He worked out and published practical methods of propagation of these and many other bulbous plants. Determination of the economic value of the American grown bulbs in contrast with the imported product necessitated intensive experimentation in their curing, transporting and storing, and especially the effects of storage temperatures upon their reaction to the forcing house conditions under which they are extensively utilized by florists. He had much hybridization of bulbous plants under way, particularly lilies and daffodils and had named and described a considerable number of promising new varieties, some of which are in process of dissemination.

His technical articles on bulb subjects, which comprise many papers in the proceedings of scientific societies and bulletins of the department, were effectively supplemented by a steady flow of less formal articles addressed mainly to a rapidly increasing audience of actual and potential bulb growers who could best be reached through such representative horticultural trade periodicals as *Florists' Exchange, Florists' Review, Seed World,* etc., in which more than one hundred articles were published. His crisp and lucid style of presentation added greatly to the practical value of these communications, for he possessed in marked degree that informal clarity of expression which while sometimes vexatious to editors is the joy and satisfaction of the lay reader.

Reared, and in the main schooled, close to the agricultural frontier of that time Dr. Griffiths developed a rare combination of scientific accuracy in his research, and sound common sense in the practical application of his discoveries. Indefatigably industrious and efficient, the work which progressively he undertook on fungi, grasses, cacti and bulbs he put his whole soul into.

Dr. Griffiths married Miss Emigene Lily in 1905, who died in 1909. A daughter, Mrs. Elizabeth Griffiths Lash, and a son, John D. Griffiths, survive, together with his widow, Mrs. Louise Hayward Griffiths, a sister and a brother.

WM. A. TAYLOR

BUREAU OF PLANT INDUSTRY

SCIENTIFIC EVENTS

PROTECTING WILD LIFE

THE possibility of new conventions for the preservation of wild life in various parts of the world was referred to by Sir P. Chalmers Mitchell, secretary of the Zoological Society of London, when presiding on April 15 at a general meeting of the Society for the Preservation of the Fauna of the Empire. Dr. Mitchell stated, according to the London *Times,* that since the last meeting the most important event, so far as they were concerned, was the final ratification by the British Government of the African Convention. They had been waiting a long time for it, but the British Government had had to consult a large number of provincial governments in Africa and other parts of the world. Now that the British Government had ratified the convention there was no doubt that the other governments whose delegates had signed would also ratify it. It was the first and a very important stage in preserving the flora and fauna of the Continent of Africa. They hoped that the convention would serve as a model for similar conventions which would gradually embrace a large part of the world. There had been an All-India conference

and the chief business was to see how far it was possible to adhere, so far as India was concerned, to the African Convention. They had reason to hope that the All-India conference would prove to be a direct step towards a conference to deal with a large part of Asia and Australasia.

One of the greatest troubles that had existed in Africa for a long time had been a plague of locusts. A new method of dealing with it by the use of aeroplanes had been adopted and a powder fatal to locusts and containing arsenic in some form had been used. It was very effective, but it also, either directly or indirectly, killed a large number of other kinds of animal life. They had been considering the matter and collecting all the information they could about it, and there was some hope now of getting a preparation which, while destructive to locusts, would not do damage to other forms of life.

The executive committee of the society reported that the fate of seals both on the southwest coasts of Britain and also in the waters of Newfoundland and Labrador continued to exercise their attention. Regarding Cornish seals they were now consulting various authorities of scientific note and were endeavoring to arrive at an unbiased view of the situation before deciding on any definite representations in official quarters.

A STUDY OF AIR POLLUTION IN NEW YORK CITY

A SURVEY of air pollution which it is hoped will provide the basis for purer air and more sunshine in Greater New York will be undertaken as a Works Division project of the Emergency Relief Bureau under the auspices of the Department of Health, according to an announcement made by Oswald W. Knauth, chairman and executive director of the bureau.

With the cooperation of Health Commissioner John L. Rice, combustion engineers, chemists and bacteriologists will take part in the work. The plan also calls for inspectors, many of whom will be engineers, who will be assigned throughout the city to watch for undue smoke from factory chimneys, apartment house incinerators, automobile exhausts, steamboat funnels and other sources of air pollution. Offending equipment will be investigated to determine the cause of the faulty combustion and each case of air pollution, whether by smoke, gas, fume, or by dust and dirt, will be reported to the Department of Health for action. The engineers will also explain how defects can be remedied and will supplement this service with an educational campaign among building owners and others, both by personal interview and by the distribution of printed technical information.

Five observation posts will be established on high buildings in the more congested districts, where hourly examinations will be made throughout the day for comparison with the Riegelmann chart, which gives a standard of comparison generally accepted in studies of this type. Dust caps will be placed at strategic points throughout the five boroughs and the accumulations in these will be analyzed, both quantitatively and qualitatively, by chemists at regular intervals for bacteriological content.

Observation posts are also to be established at Jones Beach and in Westchester to make similar readings and analyses for purpose of comparison.

SIGMA XI LECTURES

DR. KARL LASHLEY, professor of psychology at the University of Chicago, who recently accepted a call to Harvard University, delivered the Sigma Xi annual circuit lecture at the Kansas State College and at the Universities of Kansas and Missouri, giving in each case the annual initiation address. His subject was "Functional Reorganization after Brain Injuries."

Dr. Harlan T. Stetson, visiting professor at the Institute of Geographical Exploration, Harvard University, addressed the Brown University chapter on April 16 on "Earth-Moon Relations."

Professor R. A. Wardle, of the University of Manitoba, on April 11 addressed the chapter at the Iowa State College on "Zoological Problems of the Canadian West."

The annual dinner of the Rensselaer Chapter was held at the Rensselaer Polytechnic Institute on April 26. Dr. Edgar Allen, of Yale University, spoke on "The Endocrine Control of Reproduction."

Professor Robert H. Baker, of the Observatory of the University of Illinois, gave two lectures on April 16 and 17 under the auspices of the Ohio University Club on "The Present Great Problems of Astronomy" and "Beyond the Milky Way."

DETENTION OF PROFESSOR KAPITZA IN RUSSIA

PROFESSOR PETER KAPITZA, who has been conducting researches in the Mond Laboratory at the University of Cambridge, has been detained in Russia where he went to attend a conference in honor of Mendeleef. When he was preparing to return to Great Britain he was told that the government would not renew his passport as his services were needed as director of a new Institute of Physical Research under the Academy of Sciences at Leningrad.

In a long letter to the London *Times*, fully reported by wireless to *The New York Times*, Lord Rutherford says that Professor Kapitza after twelve years of work was on the eve of completing experiments expected to throw new light on the properties of matter in intense magnetic fields at the lowest possible temperatures. He further writes:

Professor Kapitza, although he long resided in England, remained a Soviet citizen and a loyal one, who regu-

larly visited Russia. By the distinction of his work in England, which added materially to the already high reputation of Russian science, he was influential in promoting happy scientific relations between Russia and Britain and obtaining for his scientific compatriots a cordial welcome in English laboratories.

While nobody disputes that the Soviet has a legal claim upon Professor Kapitza's services, its sudden action in commandeering them without any previous warning has profoundly disturbed the university and the scientific world. Professor Kapitza was not even allowed to return to Britain to discuss with the university and the Royal Society [which contributed a large sum to his experiments] arrangements for carrying on the work of the laboratory of which Professor Kapitza is director. It requires no imagination to realize how painful Professor Kapitza's own position is.

Lord Rutherford then asserts that science is international and that the facilities granted to Professor Kapitza in England are a good example of that fact. He concludes:

May we hope that the Soviet, which has given so many proofs of its interest in the development of science, will pursue a generous and long-sighted policy and see its way to meet the wishes of scientific men throughout the world by enabling Professor Kapitza to choose the environment in which he can most effectively utilize the special creative gifts with which he is endowed? It would be a tragedy if these gifts were rendered sterile by failure to grasp the psychological situation.

IN HONOR OF DR. WILLIAM ALBERT NOYES

DR. WILLIAM ALBERT NOYES, emeritus director of the chemical laboratories of the University of Illinois, has been awarded the fifth Priestley Medal, established in honor of Joseph Priestley, the discoverer of oxygen, which is bestowed every three years "for distinguished service to chemistry" by the American Chemical Society.

The first Priestley award was conferred on the late Ira Remsen, professor of chemistry and president of the Johns Hopkins University; the second on the late Edgar F. Smith, professor of chemistry and provost of the University of Pennsylvania; the third on Francis P. Garvan, president of the Chemical Foundation, and the fourth on Dr. Charles L. Parsons, secretary of the American Chemical Society.

Dr. Noyes, who is now seventy-eight years old, began his active career in chemistry as professor at the University of Tennessee from 1883 to 1886. Following that he was a member of the faculty at Rose Polytechnic Institute until 1903.

He served as the first chief chemist of the National Bureau of Standards in Washington from 1903 to 1907, in which year be became director of the laboratories in the University of Illinois, retaining that post until his retirement in 1926. As director emeritus, he has continued his active work in scientific research in the widely varied fields of organic, inorganic and physical chemistry, particularly in the field of electronic theories.

Dr. Noyes was secretary of the American Chemical Society from 1902 to 1907, and president in 1920. He edited the *Journal* of the American Chemical Society from 1907 to 1917 and established *Chemical Abstracts*, first issued by the society in 1907, himself editing the publication for two years. He has been the editor of the Scientific Monograph Series of the society since its beginning in 1909.

Dr. Noyes is a member of the National Academy of Sciences, of the American Philosophical Society, of the American Academy of Arts and Sciences, and of many other scientific organizations. He received the degree of doctor of philosophy from the Johns Hopkins University and holds honorary degrees from Clark University, the University of Pittsburgh and Grinnell College.

The award will be presented at the ninetieth meeting of the society to be held in San Francisco next August. Members of the Committee on Awards in pure chemistry are: Professor Edward Bartow, of the Iowa State University, president-elect of the society; Professor Homer B. Adkins; Dr. John Johnston; Dr. Ralph E. Gibson; Dean Frank C. Whitmore; Dr. W. H. Carothers, and Edward Mack, Jr.

LETTER OF WELCOME FROM THE PRESIDENT OF THE UNITED STATES TO THE NATIONAL ACADEMY OF SCIENCES

AT the opening of the first general session of the National Academy of Sciences on April 22, the president of the academy, Dr. W. W. Campbell, read the following letter, addressed to him from the White House, by President Roosevelt:

As you and your eminent colleagues meet in the seventy-first annual assembly of the National Academy of Sciences, I bid you warm welcome to Washington, and express my cordial wish for the greater development and usefulness of the academy.

The country has every reason to be proud of the record of its scientific men and engineers. In astronomy, medicine, physics, chemistry, geology and other sciences, and in the progress of engineering in all its branches, the contributions of America have been and still are outstanding in a friendly world rivalry.

It is a matter for thankfulness that among the many sources of world distrust and jealousies, science preserves an ideal of purity, truthfulness and mutual good will toward all nations. Not only do cooperative international scientific projects flourish, but the publications of scientists are received at face value in all lands, even though they be politically at variance.

The National Academy's charter provides that the

academy shall be ready at all times to give advice when called upon by any branch of government. This privilege has been availed of by government on many occasions. One of the most notable was during the Great War, when the National Research Council was established by the academy at President Wilson's call to mobilize the scientific learning and ability of the country to aid in that great struggle.

I take this opportunity to thank the academy for the advice and assistance it has given the administration during the past two years, particularly where problems pertaining to the scientific policies of the government have arisen.

With renewed congratulations and best wishes, I remain,

To this letter President Campbell replied as follows:

I have the great pleasure of acknowledging the receipt of your esteemed communication of to-day which extends to the members of the National Academy of Sciences a warm welcome to Washington for the holding of the Academy's Annual Meeting of 1935, and expresses your cordial wish for the greater development and usefulness of the academy.

Your letter was read to the members of the academy this afternoon at the opening of the first general assembly of this week's meeting, and I was requested and instructed to convey to you an expression of the academy's deep appreciation of your thoughtful and courteous message.

I am also requested to assure you that the members of the academy are happy in their obligation and privilege of advising the government of the United States on subjects within the domain of the physical and the biological sciences, whenever called upon by any branch or department of the government for such service, under the wise provision of the academy's congressional charter that "the Academy shall receive no compensation whatever for any services to the government."

ELECTION OF OFFICERS AND MEMBERS OF THE NATIONAL ACADEMY OF SCIENCES

DR. FRANK R. LILLIE, professor of embryology and dean of the Division of Biology at the University of Chicago, was elected president of the National Academy of Sciences at the Washington meeting. He succeeds Dr. W. W. Campbell, president emeritus of the University of California and director emeritus of the Lick Observatory. Dr. Lillie was also elected chairman of the National Research Council, in which office he succeeds Dr. Isaiah Bowman, who has been called to the presidency of the Johns Hopkins University. Dr. Fred E. Wright, of the Carnegie Institution of Washington, was reelected home secretary and Dr. Henry Norris Russell, of Princeton University, and Dr. Ross G. Harrison, of Yale University, were reelected members of the council.

Members of the academy were elected as follows:

Dr. Norman Levi Bowen, petrologist, Geophysical Laboratory of the Carnegie Institution of Washington.

Dr. Charles Manning Child, professor of zoology, University of Chicago.

Dr. George Ellett Coghill, professor of comparative anatomy and member of the Wistar Institute of Anatomy, Philadelphia.

Dr. James Ewing, professor of oncology, Medical College, Cornell University.

Dr. Merritt Lyndon Fernald, Fisher professor of natural history, Harvard University.

Dr. Harvey Fletcher, acoustical research director, Bell Telephone Laboratories, New York.

Dr. Ross Aiken Gortner, professor of biochemistry, University of Minnesota.

Dr. Earnest Albert Hooton, professor of anthropology, Harvard University.

Dr. Jerome Clark Hunsaker, professor of aerodynamics, Massachusetts Institute of Technology.

Dr. Walter Samuel Hunter, G. Stanley Hall professor of genetic psychology, Clark University.

Dr. Dunham Jackson, professor of mathematics, University of Minnesota.

Dr. Chester Ray Longwell, professor of geology, Yale University.

Dr. Harold C. Urey, professor of chemistry, Columbia University.

Dr. John Hasbrouck Van Vleck, professor of physics, University of Minnesota.

Two foreign associates were elected:

Dr. John Scott Haldane, Oxford, honorary professor and director of the Mining Research Laboratory at the University of Birmingham.

Dr. Jules Bordet, Pasteur Institute, Brussels.

SCIENTIFIC NOTES AND NEWS

DR. FRANK B. JEWETT, president of the Bell Telephone Laboratories and vice-president in charge of development and research of the American Telephone and Telegraph Company, who has been awarded the Faraday Medal for distinguished services in the field of communications, sailed for England on April 23 in order that the medal may be presented to him.

DR. RAYMOND M. FUESS, assistant professor of chemistry in Brown University, has received the American Chemical Society award in pure chemistry of $1,000 for work which resulted in the "first comprehensive theory of electrolytic solutions which, at lower concentrations, applies to all solvent media and to all electrolytes." The award, founded by Dr. A. C. Lang-

muir, recognizes "the accomplishment in North America of outstanding research in pure chemistry by a young man or woman under thirty-one years of age."

AT the commencement exercises of Washington College, Chestertown, Md., the degree of doctor of laws will be conferred on Dr. John M. H. Rowland, dean of the Medical School of the University of Maryland, and on Dr. Robert L. Swain, deputy commissioner of Food and Drugs of Maryland and past-president of the American Pharmaceutical Society.

THE doctorate of laws has been conferred by the University of Aberdeen on Professor E. V. Appleton, Wheatstone professor of physics at King's College, London; on Lieutenant-Colonel A. T. Gage, formerly director of the Botanical Survey of India and superintendent of the Royal Botanic Gardens, Calcutta, and on Dr. J. C. G. Ledingham, professor of bacteriology, University of London, and director of the Lister Institute.

AT the honorary graduation ceremony of the University of Liverpool, the degree of LL.D. will be conferred upon Charles Thurston Holland, formerly lecturer on radiology in the university, and on Professor Arthur Harden, lately head of the biochemical department of the Lister Institute.

PROFESSOR GILBERT D. HARRIS, emeritus professor of paleontology and stratigraphy at Cornell University, has been elected an honorary member of the American Association of Petroleum Geologists.

FREDERICK H. BAILEY, who has been a member of the faculty of the Massachusetts Institute of Technology since 1891, since 1907 as professor of mathematics, will retire at the end of the current academic year with the title emeritus.

GORDON M. FAIR, associate professor of sanitary engineering at Harvard University, has been promoted to a professorship.

DR. WELDON G. BROWN, now research assistant in chemistry at Columbia University, has been appointed assistant professor of chemistry at the University of Chicago in the field of inorganic chemistry. W. Lloyd Warner, now assistant professor of social psychology at Harvard University, has been appointed associate professor in the departments of sociology and anthropology.

DR. QUENTIN D. SINGEWALD, geology, and Rudolf Kingslake, geometrical optics, have been promoted to associate professorships at the University of Rochester, and Dr. Curt Stern, zoology, has been promoted to an assistant professorship. The title of associate professor now supersedes that of junior professor, hitherto employed by the university.

AT Dartmouth College the following promotions have been made: from assistant professor to professor, Leslie F. Murch, physics; W. Byers Unger, zoology, and Carl L. Wilson, botany; from instructor to assistant professor, William W. Ballard and Frank H. Connell, zoology, and William P. Kimball, civil engineering.

DURING the summer session of the Iowa State College the department of agricultural economics will be augmented by three guest professors. These are Professor J. D. Black, of Harvard University; Dr. O. E. Baker, senior agricultural economist of the U. S. Department of Agriculture, and M. L. Wilson, Assistant Secretary of Agriculture.

DR. EUGENE CHAN has been appointed acting head of the department of ophthalmology at the Cheeloo University School of Medicine, Tsinan, Shantung, China, and concurrently chief of the Eye Service at the University Hospital. He received his medical degree from Boston University and served his general internship at the Foote Memorial Hospital, Jackson, Mich. He was on the staff of the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital from 1929 to 1934. Dr. Theodore C. Greene, a graduate of the Harvard Medical School, has been appointed associate in medicine. He was formerly assistant in pathology at the Johns Hopkins University and surgical house officer at Peter Bent Brigham Hospital, Boston. He has been in China since 1927, having been connected with Douw Hospital in Peiping.

SIR P. CHALMERS MITCHELL has resigned as secretary of the Zoological Society, London.

AT a meeting on April 15 of the Royal College of Physicians of London, Lord Dawson of Penn was re-elected president.

DR. A. G. BLACK, formerly head of the department of agricultural economics at the Iowa State College and since 1933 connected with the Agricultural Adjustment Administration at Washington, has been appointed chief of the bureau of agricultural economics in the Department of Agriculture. He succeeds Nils A. Olsen, who resigned on April 15.

S. P. KAIDANOVSKY has been appointed head of the Standards Unit of the Research and Planning Division of the NRA. For the last twelve years, before his affiliation with the NRA, Mr. Kaidanovsky was electrical and industrial engineer at the plant of the Westinghouse Electric and Manufacturing Company at Sharon, Pa.

AT the second annual meeting of the Florida Botanical Garden and Arboretum Association recently held in Sebring, Dr. A. J. Grout, of Newfane, Vt., and

Manatee, Fla., was elected president of the Board of Trustees. Dr. Grout recently retired after many years of service in the Boys' High School of Brooklyn and the Curtis High School of Staten Island.

DR. E. D. MERRILL, director of the New York Botanical Garden, has returned after a visit to the Arnold Arboretum in Cienfuegos, Cuba.

DR. FORREST SHREVE and Dr. T. D. Mallery, of the Desert Laboratory of the Carnegie Institution, recently returned from an expedition to Lower California. They were accompanied by Dr. I. L. Wiggins, of Stanford University, and Jack Whitehead, of the Boyce Thompson Southwestern Arboretum. The peninsula was traversed from the boundary to Cape San Lucas, and was crossed five times at different latitudes. The objects of the expedition were the study of vegetation and the collecting of living plants and herbarium material.

DR. ARTHUR SVIHLA, assistant professor of zoology and curator of the Charles R. Conner Museum at the State College of Washington, and Mrs. Svihla will sail on June 15 for Hawaii, where they will study the breeding habits of the Hawaiian rat in cooperation with the University of Hawaii.

THE Walter Rathbone Bacon traveling scholarship of the Smithsonian Institution has been awarded to Dr. Richard E. Blackwelder, now engaged in entomological work at the U. S. National Museum, for an intensive study of the staphylinid beetles of the West Indies. Dr. Blackwelder will collect these beetles on West Indian islands and will later study the large collections in the British Museum.

DR. KARL T. COMPTON, president of the Massachusetts Institute of Technology, will give the Graduate School Convocation address at Brown University on June 15. The subject of his address will be "Patterns in Our Ways of Thinking."

DR. WILLIAM A. WHITE, professor of nervous and mental diseases at George Washington University and superintendent of Saint Elizabeth's Hospital, Washington, D. C., recently delivered a series of three lectures to physicians, social workers and educators at the New York Academy of Medicine, under the auspices of the Salmon Committee for Psychiatry and Mental Hygiene.

THE fifth lecture in the Smith-Reed-Russell series at the School of Medicine of the George Washington University was given before the faculty, students and invited guests on April 25 by Colonel Percy M. Ashburn, superintendent of Columbia Hospital, Washington. His subject was "The Medical History of the Conquest of America in the Sixteenth and Seventeenth Centuries."

THE Benjamin Knox Rachford Memorial Lectures of the University of Cincinnati were given by Dr. R. G. Hoskins on March 21 and 22. The titles of the lectures were "Endocrinology of To-day" and "Endocrine Factors in Personality."

DR. TIMOTHY LEARY, medical examiner for Suffolk County, Massachusetts, and emeritus professor of pathology at Tufts College Medical School, Boston, will deliver the eleventh Ludvig Hektoen Lecture of the Frank Billings Foundation before the Institute of Medicine of Chicago on May 24. His subject will be "Atherosclerosis, the Important Form of Arteriosclerosis, a Metabolic Disease."

DR. ELIOT R. CLARK, professor of anatomy in the University of Pennsylvania School of Medicine, formerly professor of anatomy in the University of Georgia School of Medicine, addressed a combined meeting of the University of Georgia Science Club and the Louis Dugas Journal Club of the School of Medicine, on April 15, at Augusta. His subject was "Observations on the Vascular System."

DR. A. FARKAS, of the University of Cambridge, gave the John Howard Appleton Lecture for 1934-1935 on April 17 at Brown University. He spoke on "The Chemistry of Heavy Hydrogen."

DR. REXFORD GUY TUGWELL, Under-Secretary of Agriculture, and Gifford Pinchot, formerly governor of Pennsylvania, will be among the speakers at the dinner to be given in Albany on May 15 to inaugurate New York State's celebration of the fiftieth anniversary of the Forest Commission, the forerunner of the present Conservation Department. Robert Moses, chairman of the State Council of Parks and park commissioner of New York City, and Dr. Henry S. Graves, dean of the Forest School of Yale University, will also speak. Henry Morgenthau, Jr., formerly State Conservation Commissioner, now Secretary of the Treasury, will attend the dinner. The anniversary program includes a celebration at Niagara Falls and a two-day water pageant by the Central Adirondacks Association in central New York in July and a three-day celebration at Lake Placid in September to which President Roosevelt has been invited.

A SPECIAL symposium on the virus diseases of plants, animals and man, by the Botanical Society of Washington, D. C., was held on April 24. Plant viruses were discussed by Dr. L. O. Kunkel, director of the Phytopathological Laboratory of the Rockefeller Institute for Medical Research, Princeton, N. J., and animal viruses, by Dr. Earl B. McKinley, dean of the Medical College of George Washington University.

AT the recent meeting of the American Society of Biological Chemists in Detroit, the following officers

were elected: *President,* Professor H. B. Lewis, University of Michigan; *Vice-president,* Dr. Glenn E. Cullen, Children's Hospital Research Foundation, Cincinnati; *Secretary,* Professor Henry A. Mattill, University of Iowa; *Treasurer,* Professor Cyrus H. Fiske, Harvard Medical School; *Member of the Council,* Professor J. B. Collip, McGill University; *Additional Members of the Council,* Professor H. C. Bradley, of the Massachusetts Institute of Technology, and Professor E. A. Doisy, St. Louis University School of Medicine. The next meeting will be held in Washington, D. C., in the spring of 1936.

THE twelfth initiation meeting of the University of Virginia Chapter of Sigma Xi was held on April 24. The meeting was addressed by Dr. Ernest O. Lawrence, director of the Radiation Laboratory of the University of California, who spoke on "Artificial Radioactivity." The eleventh annual award of the President and Visitors' Research Prize of one hundred dollars was granted to Dr. Alfred Chanutin, of the School of Biochemistry of the Department of Medicine, for a paper entitled, "Experimental Renal Insufficiency Produced by Partial Nephrectomy." The Andrew Fleming Prize of fifty dollars, awarded to a student in the Miller School of Biology, was given to Albert Lorz. There were twenty-one initiates.

AT the meeting of the American Academy of Tropical Medicine, which was held in New York City on April 16, the following new members were elected: Dr. Leland O. Howard, Department of Agriculture; Dr. George H. Whipple, dean, School of Medicine, University of Rochester; Dr. S. Burt Wolbach, professor of pathology, Harvard Medical School, and Dr. Hans Zinsser, professor of bacteriology, Harvard Medical School. The new officers elected were: Colonel Charles F. Craig, *president,* department of tropical medicine, Tulane University; Dr. Richard P. Strong, *vice-president,* department of tropical medicine, Harvard Medical School. The treasurer, Dr. W. W. Cort, School of Hygiene and Public Health at the Johns Hopkins University, and the secretary, Dr. Earl B. McKinley, School of Medicine, the George Washington University, remain in office. Dr. George W. Bachman, director of the School of Tropical Medicine, San Juan, Puerto Rico, was elected a member of the council to serve for two years. It was decided that hereafter the annual meeting of the academy will be held in conjunction with the meeting of the American Society of Tropical Medicine, the next meeting being scheduled for St. Louis, Mo., next November.

THE thirty-seventh annual meeting of the Medical Library Association will be held in Rochester, N. Y., from June 17 to 19. The program includes addresses, round-table discussions and demonstrations on library procedure, medical history and medical literature. The association is being represented by two delegates at the Congress of the International Federation of Library Associations to be held in Madrid from May 19 to 30. These delegates will return in time to report upon the congress. The association consists of about 175 medical libraries of the United States and Canada, together with their librarians and a group of supporting members of physicians interested in the advancement of medical libraries. The officers of the association are as follows: Charles Frankenberger, *president,* Brooklyn, N. Y.; Louise Ophüls, *vice-president,* San Francisco, Cal.; Frances N. A. Whitman, *secretary,* Boston, Mass.; Mary Louise Marshall, *treasurer,* New Orleans, La.; Marjorie J. Darrach, chairman of the executive committee, Detroit, Mich.

THE second annual Maryland Biology Teachers' Convention met at the Maryland Academy of Sciences building in Baltimore, on April 13, with 102 high-school and college teachers of biology in attendance. At the morning session, Dr. R. W. Hegner, of the School of Hygiene and Public Health of the Johns Hopkins University, spoke on "Recent Advances in Protozoology"; Elra Palmer, secretary of the Natural History Society of Maryland, on "Collecting, Preserving and Preparing Laboratory Organisms," and Dr. J. B. S. Norton, of the University of Maryland, on "Maryland Ecology." At the afternoon session, Dr. Raymond Pearl, of the Department of Biology of the School of Hygiene and Public Health of the Johns Hopkins University, spoke on "Human Biology in High School and College"; W. J. Morse, of the Bureau of Plant Industry, U. S. Department of Agriculture, on "The Soy Bean," and Dr. Herbert S. Davis, of the U. S. Department of Fisheries, on "Recent Advances in Fishery Biology and Aquiculture." In the evening the biologists were the guests of the academy to hear a lecture entitled "Glimpses of Kangarooland," by Captain Stanley Osborne. At the business session, a council of nine members was elected, with Dr. R. V. Truitt, of the University of Maryland, as chairman; Miss Marion Janney, of the Baltimore City Schools, as secretary, and Dr. C. L. Newcombe, of the University of Maryland, as treasurer. The next session will take place at the University of Maryland next spring.

ACCORDING to *The Museum News,* Secretary of the Interior Ickes has recommended the formation of an international park in the Big Bend area of the Rio Grande River. The recommendation suggests the authorization of a National Park of about 5,500 acres on the Texas side of the border and an invitation to the Mexican government to establish a park on the Mexican side, the two to form an international peace park. The area includes the Chisos Mountains and semi-arid plains along the river, the last wilderness of Texas.

DISCUSSION

INTERNATIONAL UNION OF BIOLOGICAL SCIENCES

FROM the record, it would appear that biologists are the least internationally minded of American scientists. At any rate the biologists are the only group who have not adhered to the appropriate International Union. This is perhaps a matter of surprise in view of the facts that a Union of American Biological Societies comprising 25 different organizations has been formed and is functioning effectively in the production of *Biological Abstracts* and that international congresses of botany, zoology, pathology, entomology, genetics and the like have been held at intervals for many years. The botanists, in particular, ought to be interested in a permanent organization, because the old International Botanical Congress was dissolved in 1915. A fourth congress held at Ithaca, N. Y., in 1926, a fifth at Cambridge, England, in 1930 and a sixth to be held at Amsterdam in September, 1935, continue the series in name only. There is no permanent organization, and each congress is reorganized by the botanists of the country that acts as host. The hosts are under no compulsion to recognize interim committees that may have been authorized in a sectional meeting of a previous congress, although a committee on nomenclature, including surviving members of the pre-war committee, does function by common consent. This lack of continuity from congress to congress represents a distinct loss to science not only because international cooperation is not encouraged—it is in fact discouraged—but also because of the considerable expenditure of time and energy on the part of scientists in the sterile business of effecting reorganizations. The discouragement to progress lies in the fact that interim committees are not at work on problems that from their very nature can be forwarded best if at all by international cooperation. Programs are made up by an organizing committee in one country rather than by the international groups that are intimately acquainted with the currently vital problems of a particular field. It is almost inconceivable that the subject of nomenclature should be handled in a congress without the guidance of a permanent committee that functions continuously.

The fact that microbiologists, geneticists, pathologists, ecologists and others maintain international organizations is sufficient evidence that such congresses are needed. About the only questions involved are (1) whether these groups should meet separately or whether artificial lines should be ignored and all biology be brought in for group discussions, and (2) whether the large number of groups should each meet separately or whether they should join under the leadership of the International Union of Biological Sciences and hold international biological congresses.

The objection often raised to large gatherings of scientists is not particularly important in this connection. In the first place, only biologists would be in attendance and in the second place there is no particular point to finishing off a convention in the shortest possible time. Let the sessions extend over a fortnight if there is any occasion. It is to be hoped that enough new things of international significance are found out in the realm of biology so that once in five years a period of 12 or 14 days is not too long for the proper discussion of the advances made.

The following countries are now adherents of the International Union of Biological Sciences: Belgium, Czechoslovakia, France, Great Britain, Holland, Italy, Japan, Poland, Portugal, South Africa, Switzerland. There is no reason to believe that the absence of Austria, Germany or U. S. S. R. from this list is more significant than the absence of U. S. A.

In recent months at least two societies (Botanical Society of America and American Phytopathological Society), representing about 2,000 individuals, have filed resolutions with the chairman of the Division for Biology and Agriculture of the National Research Council favoring early adherence to the International Union.

An extraordinary session of the Union is scheduled to be held in Amsterdam on September 1, 1935, to consider amendments to the statutes. A joint session of the Union, Section of Botany, and the Botanical Congress will be held on Wednesday of the same week. It is practically certain that at the joint session Professor Went will propose, as he did at Ithaca in 1926, that the two bodies merge. Such a fusion is a logical step and is likely to be voted. The Botanical Congress would thus become a permanent and continuing organization, with a central bureau subsidized by the governments of the adhering countries. The statutes of the Union are so comprehensive that the various sections which now exist or may be set up enjoy almost complete autonomy. Under the circumstances, any biological organization in U. S. A. that sponsors international congresses might well consider the advantages of the International Union as the medium for accomplishing the purposes of such gatherings. Needless to say, American botanists, who are confronted with the immediate problem of becoming eligible to participate in the joint sessions of the Union and the congress in September next, will appreciate the support which other biological organizations could give. Doubtless the Division for Biology and Agriculture of the National Research Council would welcome expression of opinion about the advisability

of adhering to the Union. If strong reasons exist for remaining out of the Union, unquestionably the division would welcome such information, as would also the 2,000 botanists who are now disposed to enter.

DONALD REDDICK

CORNELL UNIVERSITY

HEVEA RUBBER TREES IN FLORIDA

THE Hevea or Para rubber tree of Brazil (*Hevea brasiliensis*), the species that is cultivated extensively in the East Indies, has been introduced experimentally into southern Florida, where the coconut palm, mango, avocado, sapodilla and other strictly tropical plants are being grown. Some of the rubber trees have grown rapidly, and have produced fertile seeds, so that the first generation of "native-born" Heveas is in its second year. A single stunted Hevea tree at Palm Beach is the only known survivor of an earlier introduction, at the end of the last century, by the U. S. Department of Agriculture, and has shown notable resistance to unfavorable conditions. It was broken off near the ground by the fall of another tree in the hurricane of 1928, but the stump has remained healthy and new branches have developed.

Although the native habitat of Hevea is in the Amazon valley, which lies along the Equator, the susceptibility to injury by cold weather appears to be rather less than that of the Castilla rubber trees from Central America and Mexico. Many tropical plants are damaged in cool periods, even in regions where frosts do not occur, but no such tendency has been noted with Hevea, even in the young plants, many of which have continued to grow through the winter. The seasonal leaf-fall of the older trees, which is a regular habit of Hevea in the tropics, may assist the adaptation of the species to the Florida conditions. In addition to Hevea and Castilla, the rubber experiments that are being conducted at the Plant Introduction Garden at Coconut Grove include the Ceara rubber tree of Brazil (*Manihot glaziovii*), the African rubber tree (*Funtumia elastica*) and the Assam rubber tree (*Ficus elastica*), which also are thriving and seeding under the Florida conditions.

The seedlings of the Hevea tree are notably specialized for forest undergrowth conditions and have very thin leaves. Protection of the young trees against the strong trade-wind breezes of the coast districts was found necessary, and the roots must reach permanent moisture, but the older trees are relatively hardy. The most normal and rapid growth has been in pockets of the limestone reef formation below Coconut Grove, though practical tests of production possibilities are not to be made under such conditions. The first requirement for adequate testing is that supplies of native-grown seed be available for planting in many localities, so that the general range of adaptation may be learned and permanent groups of trees established where soil conditions prove favorable, to give a basis of selection. The factor of selective adaptation may be emphasized on account of the very wide range of individual diversity in Hevea.

The extent to which it will be desirable to utilize Hevea or other tropical rubber trees in southern Florida no doubt will depend upon the efficiency of production that can be attained, and upon the need that may be felt for developing new industries or of protecting ourselves against military emergencies and commercial exactions. A limiting factor at present is the denuded state of much of the interior, but with the fire hazards removed and the natural forest covering restored, the tropical reclamation might extend over half the peninsula. Desert conditions are approached in the open fire-swept country during the dry season of the winter and early spring, with the exposed sand losing heat rapidly after sunset and the dry cold air inducing frost temperatures in moist places by surface evaporation. Water that is being drained from Lake Okeechobee and higher levels farther north could be diverted for controlling fires and irrigating the tropical districts in the dry season, if large-scale developments of rubber or other tropical resources were undertaken.

O. F. COOK

BUREAU OF PLANT INDUSTRY

FEB. 2, 1935

"SLEEP" AGGREGATION IN THE BEETLE, ALTICA BIMARGINATA

As an addition to our comparatively limited knowledge of "sleep" aggregations in insects the following notes may be of value.

On July 29 and 30, 1934, while camping on a small stream near Missoula, Montana, I found large clusters of this species collected on trunks of alder trees, close to the stream. The weather was intensely hot, with maximum temperature at Missoula of 99° F., on the 29th, and a strong breeze from the southeast.

The beetles were gathered in dense clusters mostly on the leeward side of the alders in long vertical rows, occasionally one being on top of the others. For the most part they were quiet, but an occasional "sleep walker" would leave his comrades to crawl up the trunk and then down again.

I removed a lot and threw them on the ground. Here they ran aimlessly about until reaching some blades of grass up which several of them climbed to reach an alder trunk, which they ascended and wandered up and down for a time until coming into contact with other beetles, when they gradually came to rest close to their fellows.

When a wandering beetle made contact with one at rest, the latter frequently turned about as if to repel (?) the intruder, while the antennae of both were in active motion. They would then come to rest together

or the visitor might move on, as though to seek a more friendly "bed fellow."

During most of the day the beetles were in shadow, but toward evening streaks of sunlight fell upon them, causing them to shift their position, so that the configuration of the group was materially changed. Whether light or heat or both were the disturbing factors I can not say.

At 6:10 P. M. or about 5 minutes before the sun sank behind a nearby mountain, the beetles started to ascend the trees. But while the general movement was up a few of the beetles would reverse their direction and move down for a time. At 6:20, after the sun had disappeared, there was a great pilgrimage upward, but a few laggards were still "asleep." By 7:10 all but one had ascended the particular tree which I was observing, and by 7:30 all had gone up.

The following morning was partly cloudy and still. Most of the insects had moved to other trees in the vicinity, but a few were in the same location as on the two preceding days. At 9:15 A. M., or more than two hours after the sun had reached the top of the alders, a few of the beetles had come down the trunks or were wandering aimlessly up and down, while others were still in the tree tops. At 11 A. M. I noted several groups of from 10 to 20 beetles on the trunks of several trees, but many were still resting quietly on the leaves or flying from leaf to leaf, but apparently not feeding.

Further observations on the "sleep" behavior of insects and the rôle of various environmental and physiological factors in its control are desirable.

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NOTES ON THE COMMON SHRIMP

FOR about a year I have had in my aquarium a number of the common fresh-water shrimp—*Palaemonetes exilipes*. In general these specimens were fed on bread crumbs and bits of scrambled egg. One morning during the latter part of September, I introduced quite a number of mosquito larvae—(*Culex* sp.) into the aquarium. The shrimp at once began to chase the larvae. Even among the plants and grasses of the aquarium the larvae were easily captured. The shrimp held the larvae in their pinchers, introduced the still struggling larvae into the mouth and gradually consumed them.

This does not present proof that in its natural environment *Palaemonetes exilipes* eats the larvae of the mosquito. However, since it positively occurs in an aquarium, it seems probable that such is the case in the natural habitat of these shrimp. Such feeding habits make Palaemonetes very valuable economically.

G. ROBERT LUNZ, JR.

CHARLESTON MUSEUM

REPORTS

RESEARCH AT MELLON INSTITUTE DURING 1934-35

THE steady advancement of Mellon Institute during the past twenty-four years is frequently cited as an illustration of the esteem in which industrial research is held by American manufacturers. The institution was one of the first organizations in the United States founded expressly for investigating the problems of the industries, and its industrial fellowships, which have now passed the one-thousand mark, have served scientifically 3,600 companies, either as individuals or as members of industrial associations. In ten instances the inventions of fellowships have created new industries and as the results of research accomplishments of other fellowships many new branches have been added to existing manufactures. The triple function of the institute as an industrial experiment station, as a training school for industrial scientists and as a center for investigation in pure as well as applied chemistry is seen in the numerous discoveries, the successful processes and products, achieved under its auspices and in the regiment of keen research men who have here acquired specialized knowledge and experience that they are now applying productively in other fields.

In his twenty-second annual report to the institute's board of trustees, just issued, Dr. E. R. Weidlein, director, has summarized the progress during the fiscal year ended February 28, 1935. That there was a growth of the institute's activities in this period is shown by the funds contributed by the industries for the support of research, which amounted to $596,937.68, an increase of 11 per cent. over the preceding year. The money appropriated by companies and associations to the institute during the past twenty-four years amounts to $10,029,544.

At the close of the fiscal year, 56 industrial research programs, each relating to a major problem of technology, different in subject from the others, were being pursued, 16 by multiple industrial fellowships and 40 by individual industrial fellowships. Eighty-seven fellows and 29 assistants held positions thereon. Twenty-eight fellowships, or half the total number, have been in operation for five years or more, and of these fellowships 14 have concluded ten years of research, eight have been at work for 15 years or more,

d three fellowships are 20 years of age or older. ese data demonstrate that there is a growing realiion by industrialists that long-range basic research profitable. Throughout the fiscal year (March 1, 34, to March 1, 1935) 62 industrial fellowships— multiple and 45 individual fellowships—were tive; and these different investigations required the rvices of 97 fellows and 48 assistants during all or rt of the year. During the calendar year 1934, blications by members of the institute included 11 lletins, 19 research reports and 41 other papers. fty-two United States patents and 49 foreign tents were issued to fellows.

The income of the institute from industrial fellowip donors is expended in carrying on scientific reearches of concern to these companies and associaons. The institution also has funds that enable it to stain a department of research in pure chemistry nd to support certain investigations of general imortance to public welfare, such as, for example, the road study of air hygiene by H. B. Meller and his coworkers, in progress since 1928. Through its deartment of research in pure chemistry the institute according constantly increasing attention to the ncouragement of thoroughgoing investigations of ndamental chemical problems. This attitude is the sult of altruistic motives and of the realization that ch studies are essential as a background and stimus for industrial research. Since this department as founded in 1927, it has contributed much to the terature of pure organic chemistry. During recent onths its studies have been concentrated on cinchona lkaloids, in following lines which might lead to compounds of value therapeutically in pneumonia. So ar 59 different preparations have been tested for oxicity, protection against lethal doses of pneumocci in animals and pneumococcocidal power in vitro. Many biological and clinical data are being gathered y the department's medical collaborators, Drs. W. W. G. Maclachlan, H. H. Permar, John M. Johnston, Joseph R. Kenny and H. B. Burchell, at Mercy Hospital, Pittsburgh. To date the most interesting ompounds studied, from the medical point of view, ave been hydroxyethylhydrocupreine, apoquinine, thylapoquinine, and hydroxyethylapoquinine. The xperimental findings and clinical observations are eing published at the conclusion of definite stages of rogress in this large investigation. The department's taff is now constituted of Dr. L. H. Cretcher, head, Dr. C. L. Butler, Miss Alice G. Renfrew, Dr. B. L. Souther and Miss Mary Hosler.

The cooperative work with the Institute of Pathology of the Western Pennsylvania Hospital, made through arrangements with Dr. C. B. Schildecker, is being continued. These studies, which are being conducted by twelve scientists under the direction of Dr. R. R. Mellon, also pertain to pneumonia and allied pulmonary diseases. Considerable advancement has been made in an anti-pneumococcic serum and an anti-streptococcic serum.

Mellon Institute has taken an active part, during the past five years, in the preparation of the eleventh revision of the "United States Pharmacopoeia." Dr. G. D. Beal, assistant director of the institute, is a member of several of the committees, and, aided by C. R. Szalkowski, has completed a comprehensive series of studies in the five-year period. Six researches have been published and as many more will appear soon.

Information concerning the subject-matter and progress of many of the industrial fellowships is not releasable, but the institute is privileged to describe some of the developments during the fiscal year, as follows: The carbon black fellowship, whose incumbent is Dr. C. W. Sweitzer, has made a basic investigation of the dispersion properties of carbon blacks that has led to the development of a method for colloidally dispersing carbon black pigments in lacquer vehicles, this colloidal dispersion resulting in markedly improved properties for the black lacquer. The fellowship on ceramic chemicals has given attention to several aspects of enameling procedure, and W. J. Baldwin, the incumbent, has carried into the plant stage of development an improved enameling process. A research creation of the multiple fellowship on protected metals, "Tile-Faced Robertson Protected Metal," developed by D. S. Hubbell, has been shown to have an immediate, broad market in the building material field, because of the combination of an attractive ceramic surface upon a core of asphalt-asbestos protected metal. The multiple fellowship on refractories, headed by S. M. Phelps, has continued research on new test methods for evaluating progress in developmental work and for the control of commercial products while being manufactured, and has evolved the panel spalling test and two improved analytical methods. The same fellowship has also investigated the effect of furnace gas pressure on the behavior of refractories in industrial furnaces. During the past two years Dr. B. H. Gilmore, on the calgonizing fellowship, has carried out comprehensive research on the rôle of sodium hexametaphosphate in sequestering calcium and magnesium ions as they affect detergent operations in which soap is used or formed. By removing these ions from solution without precipitation, the curdling effect of hard water upon soap is completely inhibited and the soap used in washing operations is held in solution to exercise its full detergent action. Sodium hexametaphosphate, in consequence, is being employed extensively in laundering and in mechanical dishwashing; it is also useful for cleaning the foliage of evergreen shrubbery and for

pet-washing. Drs. W. W. Duecker and C. R. Payne on the multiple fellowship on sulfur have found that acid-resistant cements, made by combining sulfur with an aggregate, can be improved by the addition of certain olefine polysulfides, and that such modified cements are valuable bonding agents and protective coatings in structures subjected to acids or corrosive solutions. On the shaving fellowship E. J. Casselman has been studying safety-razor guard-bar design and razor-blade quality; he has developed a procedure that has resulted in the advancement of the technique of controlling factory methods for sharpening blades as well as enabling the manufacturer to specify the correct quality of blade steel. The multiple fellowship on organic synthesis (Dr. E. W. Reid, senior fellow) has been remarkably successful in preparing new, commercially valuable compounds for a wide variety of uses: glycol ethers, novel plasticizers, new types of vinyl resins, triethylene tetramine, and morpholine derivatives. Two new strained foods (a cereal and apricots) have been developed by the food varieties fellowship, and E. R. Harding, the senior fellow, and Miss Helen B. Wigman have continued their study of vitamin C. On the sugar fellowship Dr. G. J. Cox and Miss Mary L. Dodds attained in 1934 results that suggest the existence of a factor which, if present in the diet during a critical period of tooth formation, will aid in the construction of teeth resistant to decay. The useful chemicals that this fellowship demonstrated could be produced from sugar, such as sucrose octa-acetate, calcium levulinate and the ethers of levulinic acid, are now being manufactured by an industrial organization.

Seven new fellowships began operation during the fiscal year—starch, stone, closure, zymology, demulcent, laboratory and thread. Another fellowship, on soya bean, started work on March 1, 1935. The following fellowships concluded their research programs during the year: cleaning, velvet, vanadium, sugar, phosphates and paper finishing.

It is announced that the new building of the institute will be gradually occupied during 1935. The chemical engineering quarters are practically finished and many of the new laboratories will be ready for occupancy within the next few months. It is planned to have the building completed by the end of 1935. The first use of the edifice was to house the Science Exhibition held in connection with the Pittsburgh meeting of the American Association for the Advancement of Science. More than 25,000 persons visited this exhibition, which was open from December 27 to 30, 1934.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

PARADICHLOROBENZENE, AN EFFECTIVE HERBARIUM INSECTICIDE[1]

THE plants in an herbarium must be kept free from pests. This is commonly done by periodic fumigation with hydrogen cyanide or carbon bisulfide. Such methods require either an airtight case in which to carry on fumigation or the general herbarium cases sufficiently airtight to retain the fumes within the case. Both methods may have serious after-effects if the substances are not adequately cleared out of the air. In our case with neither a fumigating case and far from airtight herbarium cases, neither of these methods could be used. Routine poisoning of new specimens checked the introduction of new pests but did not free the old plants.

Taking a tip from the entomologists, we decided to try out paradichlorobenzene. We have found it an immense success. In practice a small unsealed envelope with about a heaping teaspoonful of paradichlorobenzene is put somewhere in the herbarium case. In our practice one such envelope is put at the bottom of the case and does for two columns of 17 pigeonholes each. The chemical volatilizes in the course of two or three weeks. The fumes penetrate the compartments and in a few days diffuse out around the doors. We have done this for our whole herbarium towards the close of the school year for the past two years. In the first fall following this treatment, we were able to find living pests in a bulky specimen of Asclepias, a few pupae in other Asclepiases and in one legume. Thousands of dead larvae and pupae scattered through the herbarium were mute testimony to the action of the paradichlorobenzene. Following the second year of such treatment, we have been able to discover no living pests anywhere in the herbarium.

The same substance may be employed in fumigating duplicates or in recent accessions which have not yet been mounted. The simple practice is to put a small amount in an envelope in the ordinary pasteboard boxes that plants are stored in and allow it to remain until one is ready to use the plants. No effort is made to keep these boxes airtight, but they are usually tied up. In thus treating one group of plants

[1] Contribution No. 346 from the Department of Botany and Plant Pathology, Kansas State College of Agriculture and Applied Science, Manhattan, Kansas.

which we knew to be very badly infested with larvae, we closed the box with gummed paper except for one corner where a small hole about 2 mm wide was left. When this box was opened up a month later, hundreds of dead larvae were found in the immediate vicinity of this hole in the box and still more hundreds were in the plants in the sheets from which they had been unable to escape.

The substance paradichlorobenzene kills not only the larvae and pupae, but also the eggs. It, of course, takes longer exposure to kill the eggs, but entomologists feel that the presence of a highly saturated atmosphere for two weeks will do this. It is our experience that this is undoubtedly the case.

In summary, paradichlorobenzene has been found to be an inexpensive, very proficient means of carrying on herbarium fumigation *in situ*, as it kills all forms of the pests with a minimum of caretaker's discomfort and is not a fire hazard.

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AN IMPROVED METHOD FOR SEED GERMINATION

IN germinating seeds on either wet blotting paper or towelling paper, certain difficulties are often encountered. Chief of these is the development of root hairs into the surface of the substrata and subsequent difficulty in removing the germinated seeds without injury. A second problem is met with in keeping the seeds in a humid atmosphere most conducive to germination. The method described was designed to eliminate these problems.

Number 300 Cellophane (thin wrapping Cellophane), previously soaked in distilled water for a period of an hour or more to remove the glycerine, is placed wet upon a saturated pad of several sheets of blotting paper, or paper or cloth towelling. The Cellophane presents a very smooth surface to which the root hairs do not adhere.

The seeds are placed on the Cellophane and the blotting pad is placed in the bottom of a miniature greenhouse or other suitable enclosure, such as a bell jar. Thus a moist atmosphere is provided and excessive evaporation from the blotting pad is prevented.

In case seeds are to be germinated for planting purposes, sterilized wet fine sand may be used in place of the Cellophane and blotting pad. In this case, the seeds should be oriented for planting, the radicle in a vertical position. Seeds as large as those of pea, bean and corn may be germinated successfully in this manner.

A particular advantage of using glass-topped boxes or bell jars lies in the fact that the process of germination may be observed without disturbing the seeds. This procedure is good for preparing germinated seeds for the demonstration of root hairs.

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SPECIAL ARTICLES

MENINGITIS IN MAN CAUSED BY A FILTERABLE VIRUS

DURING December of 1934 two adult males, W.E. and R.E.S., developed an illness characterized by headache, vomiting, stiff neck and a high cell count, 1,700 and 720 per c.mm., respectively, in the spinal fluid. The cells in the fluid were practically all mononuclear elements. Both patients made a slow uneventful recovery and are now well.

The clinical pictures presented by the patients were almost identical and suggested a virus meningitis. Consequently, spinal fluid from each of them was inoculated intranasally, intraperitoneally and intracerebrally into 6 Swiss albino mice.

Of the 6 mice that received W.E.'s spinal fluid, one died on the third day of a streptococcal infection and was discarded. The remaining 5 mice became sick 6 or 7 days after inoculation. One of them died and was discarded, 2 were allowed to recover and 2 were killed in order to prepare a brain emulsion for intracerebral inoculation of other mice. The second lot of mice became sick about a week after inoculation and some of them were sacrificed for passage. By means of emulsions of bacteriologically sterile brain material injected intracerebrally into mice the active agent has been passed serially through 10 lots of mice and at present small amounts of a 10 per cent. emulsion of infectious brain material kill practically all the mice in 7 days.

In a similar manner an active agent free from bacteria was obtained by the inoculation of R.E.S.'s spinal fluid into Swiss mice. The virus has been passed through 9 sets of mice and reinoculation experiments clearly show that the W.E. and R.E.S. strains are immunologically identical.

Mice inoculated intracerebrally with either strain of virus become sick within 5 to 7 days and lose weight rapidly. Their fur is ruffled. Only a few of them develop signs referable to the central nervous system which consist of irritability and convulsions. No paralyses have been noted. The virus is in the brain, liver, lungs and blood. Mice inoculated intraperi-

toneally become sick, but only a few of them die. Intranasal inoculations of the virus cause no visible illness in mice but immunize them against the virus injected intracerebrally. The chief lesions found in mice are a mononuclear cell meningitis, a hyperplasia of Kupffer cells in the liver, and a pneumonia similar to that caused by other filterable viruses.

The virus causes no lesions in the skin of rabbits, and when it is inoculated intracerebrally the animals only exhibit a fever of short duration. We have no definite evidence, therefore, that rabbits are susceptible to this active agent.

Guinea pigs are susceptible to both strains of the virus inoculated either intracerebrally or subcutaneously. A high continued fever (104–106° F.) and loss of weight are the striking features of the infection in this host. Death usually occurs 10 to 14 days after intracerebral inoculation and many of the pigs die after subcutaneous injections. A slight meningitis or a virus pneumonia is all that our pathological studies have revealed so far.

Monkeys (*M. rhesus*) are susceptible to the active agent introduced intracerebrally, as evidenced by high fever, loss of weight and irritability. No paralyses have been noted. From the small number of monkeys injected we judge that the disease will not as a rule be fatal for this host.

From tissues containing the active agent no ordinary bacteria that might be of etiological significance have been cultivated. Furthermore, the virus passes through Seitz pads, Berkefeld V, N and W candles, and collodion membranes possessing an average pore diameter of 210 μμ. Additional work is under way to determine the size of the virus.

The results of our experiments seem to indicate clearly that the virus was obtained from the spinal fluid collected from the two patients and that it is pathogenic for man. Two mice that received W.E.'s spinal fluid and recovered and 5 mice that received R.E.S.'s spinal fluid and did not become sick were later found to be solidly immune to virus introduced intracerebrally. We have not encountered any immune animals among our stock mice. Consequently, we believe that the immune mice mentioned above realized that state through having received an immunizing dose of virus in the spinal fluid. Furthermore, neutralization tests conducted in mice and guinea pigs show that serum collected from the patients at the beginning of their illness fails to neutralize the virus, while serum collected late in convalescence does inhibit its activity. In passing it should be noted that neutralizing antibodies appear very slowly in the sera of guinea pigs, monkeys and human beings convalescing from an infection with the virus.

Our virus is not similar to any active agent heretofore described, with the exception of those of Armstrong and Lillie[1] and Traub.[2] The former workers speak of the source of their virus in the following manner: "It is not apparent whether this virus came from the case C.G. or from one of the monkeys used in the transfer of virus from this case. In either event the virus was apparently in a latent state and was activated during successive transfers." Traub has clearly shown that he recovered his virus from stock mice. We are confident that our strains of the virus were obtained from the spinal fluids of two patients and that it is pathogenic for man. Through the cooperation of Dr. Armstrong and Dr. Traub it has been possible for us to show that the viruses recovered from the three sources mentioned above are either immunologically identical or at least very closely related.

Many filterable viruses naturally attack the central nervous system of man and lower animals, causing an encephalitis and can be recovered from the brain or spinal cord. So far no virus has been shown to produce a clean-cut picture of meningitis in man. The new agent with which we are working seems to be able to produce such a picture and to appear in appreciable amounts in the spinal fluids of affected individuals. Whether this virus produces only a picture of meningitis in man and how great a rôle it plays in diseases of the central nervous system remains to be determined.

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ON CYMAROSE

CYMAROSE is a methyl ether of a 2-desoxy hexomethylose (2-desoxymethylpentose) which occurs in the cardiac glycosides cymarin and periplocymarin. It was first obtained by Windaus and Hermanns[1] from cymarin. They noted that it gave no phenylosazone, but that it yielded acetic acid on oxidation with silver oxide and exhibited the color reactions of digitoxose. They therefore suggested that it may be a methyl ether of this desoxysugar. Attempts to demethylate it to digitoxose were unsuccessful and the position occupied by the methoxyl group as well as its precise configuration remained undetermined.

It is now possible definitely to allocate the methyl ether group at the third carbon atom of the desoxyhexose chain. When cymarose was oxidized with 50 per cent. nitric acid, a hydroxymethoxyglutaric acid

[1] C. Armstrong and R. D. Lillie, *Pub. Health Rep.*, 49: 1019, 1934.
[2] E. Traub, SCIENCE, 81: 298, 1935.
[1] A. Windaus and L. Hermanns, *Ber. chem. Ges.*, 48: 979, 1915.

was formed which was characterized by its di-N-methylamide. The latter melted at 138° and showed $[\alpha]_D^{24} = -55.3°$ ($c = 1.410$ in water).

$C_8H_{16}O_4N_2$:				
Calculated.	C 47.04,	H 7.89,	OCH_3 15.19,	(N)CH_3 14.70
Found.	" 47.12,	" 7.42,	" 15.70,	" 13.41

It was also possible to isolate the lactone of this acid which melted at 150–152° and showed $[\alpha]_D^{24} = -1.2°$ ($c = 1.720$ in water).

$C_8H_8O_5$.	Calculated.	C 45.00,	H 5.00,	OCH_3 19.37
	Found.	" 45.15,	" 4.98,	" 19.22

On direct titration and saponification the alkali consumption corresponded to one carboxyl and one lactone group, respectively. From this it is obvious that in order that lactone formation may take place the hydroxyl group of this acid must be on a carbon atom adjacent to one of the carboxyl groups. This leaves only the β carbon atom as the position for the methoxyl group. Otherwise, the highly improbable assumption of the presence of a β lactone must be made. By reference to the cymarose molecule it follows from this that the methoxyl group is on the third carbon atom of the desoxyhexose.

Details of this work, together with the exact determination of the configuration of cymarose, will appear later.

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THE EFFECT OF PRACTICE UPON INTER-CORRELATIONS OF MOTOR SKILLS

EXPERIMENTS on the interrelations of speed[1] tests in fine motor skills have indicated quite consistently that these tests are either highly specific or at most related only within very narrow groups of movement patterns, *e.g.*, as in McCollom's tapping tests.[2] According to Seashore,[3] an intercorrelation of approximately + .25 would be a representative figure for such tests, but such results have been challenged, since learning curves have been involved, and testing may not have been done near enough to hypothetical physiological limits. The critical test is to train observers until they are making little improvement, comparing the intercorrelations between the various motor tests at the beginning and end of the practice period. If intercorrelations increase materially by the end of the practice period, it would favor the theory that a general factor or perhaps several large group factors are basic to more complex motor skills.

The Koerth Pursuit Rotor[4]—a test of simple eye-hand coordination in following with a stylus a target mounted on an insulating disk, which is revolved quite rapidly by a phonograph motor—and the Brown Spool Packer[4]—a test of eye-two-hand coordination in speed of packing spools into a tray—were selected as unlike performances. If, after practice, intercorrelations raised materially between these qualitatively very different skills, the evidence would strongly favor the theory of a general motor ability or large and overlapping group factors.

To test for a possible narrower group factor, this experiment included two tapping tests which are known to be unrelated in early trials, but which seem qualitatively enough alike to belong to a single "basic motor capacity" which might be determined by a hypothetical physiological limit of neuro-muscular arm speed. These two tests were McCollom's simple tapping of a telegraph key and the alternate tapping of two brass plates with a stylus, both for speed. If sheer physiological limits are the basic determiners of fine motor speeds, this should be shown by a raise in the intercorrelations of these two tests.

A lengthy preliminary study determined the respective learning curves and the number of trials necessary to reach approximate limits of improvement on each test. Practise periods were given by the rotating cycle method, so as to avoid fatigue. A single cycle consisted of: 5 trials of 20 revolutions each on the pursuit rotor; 3 trials of 5 seconds each on the telegraph key; 2 trials of 1½ minutes each on the Brown Spool Packer; 5 trials of 20 revolutions each on the pursuit rotor; 3 trials of 5 seconds each on alternate tapping. Three cycles per day were performed at the same hour on alternate days, so that a total of nine cycles, or about three hours of spaced practice, was had by each observer. Motor tests are usually interesting to men, and the citation of electrical counter scores after each trial added a distinct motivation to the performances.

Fifty male right-handed laboratory students acted as observers, none of them having had previous practise on these tests.

Correlations between scores on cycles 2 and 3 (first day) in each test were determined for reliabilities, and these were duplicated for cycles 8 and 9 (third day). Intercorrelations for the four tests were computed from the total of scores on cycles 2 and 3 (first day) and similarly from totals of cycles 8 and 9 (third day). Since the intercorrelations between the tests were determined from the sum of two cycles, while reliabilities were computed from the correlation

[1] The results of steadiness tests and large muscle athletic coordinations must be considered separately from *fine* motor *speed* coordinations; *cf.* Seashore and Adams, SCIENCE, 78: 2022, 285–287, September 29, 1933.

[2] I. N. McCollom, "Analysis of Factors Determining Individual Differences in Speed of Simple Repetitive Motion," unpublished thesis, University of Oregon Library.

[3] R. H. Seashore, *Jour. of Gen. Psychol.*, iii: 1, 38–66, 1930.

[4] R. H. Seashore, *Psychol. Monog.*, xxxix: 2, 51–66, 1928.

TABLE I

EFFECT OF PRACTISE ON INTERCORRELATIONS OF FOUR MOTOR SPEED TESTS

	Koerth Rot.			Tel. Tap.			Br. Sp. Pkr.			Alt. Tap.		
Koerth Rot.	*.91		*.85	.25		.39	.32		.31	.08		.02
	(.95)	−.03	(.92)		+.14			−.01			−.10	
Tel. Tap.				*.77		*.91	.40		.14	.30		.07
				(.87)	+.08	(.95)		−.26			−.23	
Br. Sp. Pkr.							*.86		*.88	.15		.04
							(.93)	+.01	(.94)		−.11	
Alt. Tap.										*.81		*.84
										(.90)	+.01	(.91)

Light figures = results of first day's practice. Heavy figures = results of last day's practice. Figures showing plus or minus variation as result of practice indicated by algebraic sign. * = reliability coefficients; Brown Spearman figures in parenthesis.

between single cycles, the *reliability* of the measures intercorrelated was estimated by the Brown-Spearman prophecy formula, as shown in parentheses below each of the obtained reliability coefficients.

As seen in Table I, intercorrelations between the four motor skills at the beginning of the practice period (light figures) verify the previous findings of low positive correlation between these separate skills, ranging from r=+.08 to r=+.40, approximating a value of r=+.25. After the practise period the correlations (in heavy figures) are somewhat lower than at the beginning of practise. They now range from r=−.02 to r=+.39, averaging r=+.16. Four of the six interrelationships now approximate zero, suggesting that the effect of intensive practice, if anything, is to make such motor skills not only more specific than they were at first, but practically independent variables. Reliability coefficients for both sets of intercorrelations are high, tending slightly higher after practice.

The correlation between the Koerth Pursuit Rotor and Brown Spool Packer (unlike tests) changed but very little (−.01), denying the importance of general factors of motor skill. The correlation between telegraph tapping speed and alternate tapping speed dropped from +.30 ± .09 at the beginning of practice to +.07 ± .10, denying even the existence of a group factor large enough to include only tapping performances.

It is therefore concluded that with instrumentally controlled testing and statistically reliable measures, the effect of practise on the intercorrelations of speed in fine motor skills is, if anything, to decrease their relationship, thus upholding previous findings as to the specific nature of the skills tested. Our results do not support the hypothesis of one or a few physiological limits, such as neuro-muscular arm speed, which might be thought of as determinants of success in numerous fine motor speed skills.

The results accord closely with studies by Walker and Adams[5] and S. Seashore[6] on knitting machinery, in both of which a battery of motor tests showed negligible predictive relationship to objectively measured complex practical skills. Such continued demonstrations of the specificity and non-predictability of individual differences in fine motor skills make it seem more profitable to direct further research toward the most effective methods of direct training in motor speed skills.

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[5] R. Walker and R. Adams, "Motor Skills: The Validity of Serial Motor Tests for Predicting Typewriting Efficiency," *Jour. of Gen. Psychol.*, July, 1934, 11, No. 1, pp. 173–186.

[6] S. Seashore, *Psychol. Bull.*, 27: p. 653, 1930.

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